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IDENTIFIERS *Project CAPABLE

ABSTRACT

Project CAPABLE (Classroom Action Program: Aim: Basic Learning Effectiveness) is a classroom approach which integrates the basic learning skills with content. The goal of the project is to use basic learning skills to enhance the learning of content and at the same time use the content to teach basic learning skills. This manual illustrates how the Classroom Action Program exercises might be used to develop a work unit that integrates basic learning skills and content. A model unit is presented which was written for a sophomore biology course using the text "Modern Biology," by James H. Otto, Albert Towle, and Myra E. Madnick, "Chapter Six: Photosynthesis, Respiration, and Cell Energy." Examples for 20 program components, or "pearls," are given. Classroom Action Program techniques must be chosen to best suit the course; student needs; and the teacher's style, background, and expertise. (BS)

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PROJECT
CAPABLE

MODEL UNIT

PROJECT

CLASSROOM
ACTION
PROGRAM:
AIM:
BASIC
LEARNING
EFFECTIVENESS

U.S. DEPARTMENT OF EDUCATION
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"To Help Each Student Become a More Capable Learner"

Madawaska High School
Madawaska, Maine
ESEA Title IV-C

PROJECT CAPABLE

A TITLE IV-C PROJECT...

...DEVELOPED BY TEACHERS OF

MADAWASKA HIGH SCHOOL
MADAWASKA SCHOOL DISTRICT
80 - 7th Ave.
Madawaska, Maine 04756

Project CAPABLE has been funded under the Elementary and Secondary Education Act (ESEA) Title IV-C, Public Law 93-380. Seed money provided by this public law enables school districts to develop ideas for solving educational problems, to apply and to refine these ideas, to determine their feasibility, to establish working models, and to demonstrate the adaptation or adoption of these models by other school systems.

Pre-Project: A workshop was conducted with the faculty members of Madawaska High School. The staff was asked to identify those skills which students lacked that hindered their ability to learn their subject matter. As a result of this workshop, Project CAPABLE was conceived. A project team composed of teachers from several content areas was selected.

Year One: During the first year of the project, teachers were involved with intensive research to determine what the basic learning skills are and how they are learned. This research was accomplished through professional literature and workshops presented by several knowledgeable experts in the field.

Year Two: The second year was spent in writing learning units which systematically integrated basic learning skills with content.

Year Three: The final year of the project was used to implement these learning units in the classroom, to evaluate, and to revise them. Additional units were also written.

Future: Participating teachers will continue to develop the project in their classrooms. Since several departments are represented, these teachers will serve as a nucleus within the school to assist other teachers. The project can serve as a model program for other schools that would be interested in adopting it.

PROJECT TEAM	DEPARTMENT	PROJECT INVOLVEMENT
Paul Germann Director	Science	Yr. 1,2,3
Terry Murphy Co-Director	English	Yr. 1
Don Clavette	French	Yr. 1,2,3
Mike Crawford	Social Studies	Yr. 1,2,3
Rena Labbe	English	Yr. 2,3
Claire Labrie	Science	Yr. 1
Phyllis Perreault	Business	Yr. 1,2,3
Kermit Pooler	Special Education	Yr. 1,2,3
Gisele Cyr	English	Yr. 1,2
Harry Sea	Mathematics	Yr. 1,2

Superintendent
John Houghton

Assistant Superintendent
Melvin Labbe

Principal
Lester Ouellette

PROJECT
CAPABLE

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PROJECT CAPABLE

in a nutshell...

Students have difficulty learning because they lack basic learning skills necessary to make learning possible. We believe that it is a widespread problem, especially with students who have difficulty learning. We feel that high school content teachers are not trained to respond to deficiencies in learning skills. Many content teachers assume that the necessary skills have already been taught in the lower grades. Content teachers must be as aware of learning skills as they are of their content. Their classroom goal should be to use basic learning skills to teach content which, at the same time, use content to enhance basic learning skills. In this regard any high school teacher in any school district can benefit from a project such as ours.

THIS MODEL UNIT - ITS PURPOSE

The Project Capable Implementation Manual attempts to give you an overview of the various components of the project and provide some direction towards its implementation. It is the intent of this companion manual to illustrate how the Classroom Action Program and its exercises might be used to develop a unit of work that integrates basic learning skills and content.

This model unit has been written for a sophomore biology course using the text Modern Biology by James H. Otto, Albert Towle, and Myra E. Madnick, "Chapter Six: Photosynthesis, Respiration, and Cell Energy." This selection was chosen because we have found biology to be one of the subject areas that seems particularly suited to the broadest and most frequent use of the techniques of Project CAPABLE. Other content areas, chapters, or units can use some project techniques more often and others less often. Each area is different, as is each chapter or unit, each teacher, each class, and each student. Techniques must be chosen to suit these variables as well as possible.

This model unit is not meant to provide examples in your area of expertise. We realize that you want to see how the project works in your subject area, and other materials are available that provide examples of each technique in as many different subject areas as possible.

Also, this model unit is not intended to offer instruction in how to write and use the Project CAPABLE techniques in the classroom. This kind of instruction is most appropriately provided through workshops with plenty of practice and follow up.

Other materials have been or will be prepared to offer case studies to illustrate how each technique is actually used in the classroom. Sample teacher and student packets in a variety of subject areas using as many appropriate techniques as possible will also be available.

ADD A PEARL!

The Directed Learning Activity of the Classroom Action Program is like the setting to a fine and exquisite ring. The course philosophy and objectives, analysis of the text, outline of the chapter, concept maps, chapter goals and objectives, tests, learning strategies, analysis of basic learning skills, the learning exercises, the student preparation activities, and the discussion and comprehension check are like pearls and gems that can be added to this setting, one by one.

The development of your Classroom Action Program is a big job. To attempt too much at once would only lead to discouragement. It is suggested that you "add a pearl" each year.

No one will have the same approach. Each teacher must design a Classroom Action Program that will best suit the course, the needs of the students, and the style, background, and expertise of the teacher. Each program will be unique.

PEARL ① COURSE PHILOSOPHY

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The course philosophy is a description of the general principles underlying the teaching and learning of content in the course. It described in general terms what the outcome of the course should by and why. The course philosophy begins with the needs of society and proceeds to describe what students need to learn to meet those needs. In this way the course philosophy reflects the teacher, school, community and nation.

CLASSROOM ACTION PROGRAM

I. Course
   A. Course Philosophy
   B. Course Goals and Objectives
   C. Unit Goals and Objectives
II. The Directed Learning Activity
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      2. Concept Map
      3. Chapter Goals and objectives
      4. Write a Test
      5. Learning Strategy Worksheet
      6. Learning Strategy
      7. Write Exercises
         a. Advanced Organizers
         b. Directed Reading Lessons
         c. Concept Development
         d. Study guide
         e. Content Aids
         f. Critical Thinking
         g. Vocabulary
         h. Graphic Aids
         i. Quiz
         j. Calendar
         k. Student Guide and Checklist
   B. Student Preparation
      1. Orientation/Introduction
      2. Motivation & Attention
      3. Vocabulary/Clarification of Concepts
      4. Background
      5. Purpose Set
      6. Skill Review/Direction Review
   C. Activity
   D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"We talk philosophy all the time but when we need to write it down it is necessary to go through a serious self-analysis. I genuinely enjoyed writing my philosophy of teaching. It was in that process that I discovered what I really stand for as a teacher."

TOWARD A PHILOSOPHY OF SCIENCE EDUCATION

During the past several years we have been in the process of re-evaluating our science courses in America in light of the criticism that has been leveled at these courses as they have been taught on all levels - elementary, secondary, and college.

Morris H. Shamos, in an article in The Science Teacher, points to a disturbing paradox. In a world which depends upon the fruits of science to such a large extent, the vast majority of our population is scientifically ignorant. In light of all that has happened in the past few decades to point up the significant role of science in this and future generations, so many students avoid science even as a cultural imperative, and their parents continue to display their ignorance of this field as a badge of honor. Science teachers must ask themselves why this is so since whatever exposure our population has had to this discipline has been of their making. It would seem that either science is basically unteachable or we have yet to learn how to teach it properly. We seem to feel that it is important to impart upon our students a basic literacy in literature, art, music, history, social problems, etc., but fail to see the importance of developing a common literacy in science.

Just look at the curriculum of any high school or college. High schools require several courses of English, history, religion (in church related schools), but require only one year, if any, of a science. Our liberal arts colleges require several courses of such areas as philosophy and history. In high school, science is suggested only for those who intend to go on in the sciences upon entering college. In college,

science is suggested for science majors only.

What is meant by a common literacy in science? Obviously, we don't mean that our students be able to solve scientific problems by themselves. This is the task of the specialist. Nor do we mean that our students should have an encyclopedic knowledge of scientific facts. Facts by themselves do not constitute what science really is.

What is meant by a common literacy in science is that an educated man should know science for his own good. It is a part of his culture, just as are history, philosophy, literature, and the fine arts. He should have a sense of security about his everyday observations; a feeling that he understands his environment reasonably well. He should know facts of nature, not as a substitute for science, which is too often the case, but he should understand how these facts are used in developing major concepts in science. To do this we must base our science education upon ideas that will be remembered and not upon trivia.

As in other tasks, the best place to begin is at the beginning with a description of what science is all about. The scientific enterprise has three distinct aspects: descriptive science, technology (or applied science), and science (or pure science). To teach an adequate appreciation of the scientific enterprise we must teach a balance of all three of these aspects; taken alone each would provide a distorted view of the nature of science.

The major part of the curriculum of most elementary, high school, and introductory college courses are often comprised of discriptive and applied science. This type of curriculum is self-defeating in two ways. First of all, scientific knowledge tends to increase in a logrithmic

A PHILOSOPHY OF EDUCATION IN THE BIOLOGICAL SCIENCES

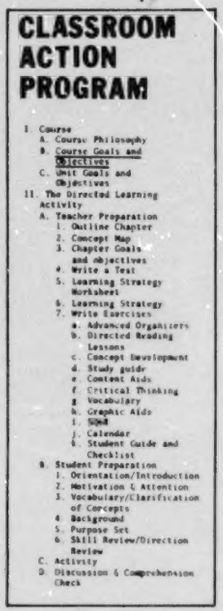
The students should have a basic understanding of science and scientific processes. This is to build a scientific literacy in order aid in the preparation of the students for later responsible citizenship. The aim should be to teach science as a way of thinking, as a way of seeking answers. To do this, we stress underlying concepts and understandings. Student work is centered in the laboratory where real problems are explored; open-ended experiments and other materials are used as the media for conveying an understanding of science. Through emphasis on basic concepts and illustrations of such concepts in many varying ways, the student should be given practice in drawing generalizations, in seeking relationships, and in finding answers.

PEARL ② COURSE GOALS & OBJECTIVES

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

CLASSROOM ACTION PROGRAM



I. Course
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  C. Unit Goals and Objectives
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    6. Learning Strategy
    7. Write Exercises
      a. Advanced Organizers
      b. Directed Reading Lessons
      c. Concept Development
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. Skad
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

RATIONALE

The course goals and objectives are a natural outgrowth of the course philosophy. These are a list of the main ideas, or schemes, that the student will be expected to learn while studying the chapter. They may include values and attitudes if it is called for by the philosophy. The course objectives describe what is to be put into actual practice in the classroom as a result of the course philosophy.

TEACHER/STUDENT REACTION

"The course goals and objectives have served me in two ways. First, they serve as an overview to the course. I can see at a glance what the course is all about. Second, it helps keep in focus what I expect my students to know when they finish the course."

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BIOLOGY COURSE GOALS

The goals of a high school biology course should be:

1. to give the students an understanding of the place of science among other intellectual and esthetic persuits; briefly, to see the sciences as being themselves a humanistic enterprise as much as literature, the arts, history, and religion, connected closely with them while differing from them;
2. to free the student from unreasonable fears that stem from ignorance by increasing their knowledge and appreciation of a world of living things around them.
3. to give students the opportunity to develop critical reasoning.
4. to give students a scientific background in the basic biological schemas and concepts that will enable them to be literate in the world of current biological advances and thereby be more able to make rational judgements concerning these advances as well as being more comfortable when reading or talking about science on a non-technical level. These biological schemas would be:
   A. the relationship of cause and effect - the student should understand that things don't just happen by themselves, but have definite causes.
   B. the history of biological discoveries and concepts - the student should appreciate how scientific ideas grow and develop, and how mistakes and the limitations of method confine and restrain the concept at a particular time.
   C. scientific method and procedures - the student should have

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OBJECTIVES OF UNIT ONE: THE NATURE OF LIFE

In Unit One we will be concerned with the "Nature of Life." We will try to uncover, if we can, what the quality of "life" is, or, in other words, what do living things have that make them living and thereby different from non-living things. We begin by investigating those things that all living things do that non-living things do not. We will assume that they are able to do these things because they have "life." This does not tell us what life is. (Chapter II)

We discover that the basic working unit of life is the cell. Therefore, to understand what life is and how organisms composed of cells function, we will have to take a close look at the cell's structure and inner workings. To prepare ourselves for this investigation, we study some simple chemistry. This is necessary because we soon learn that the structures of the cell are composed of chemical compounds and that any activities a cell does is done by means of chemical reactions. (Chapter III)

With this foundation we are prepared to study the parts of the cell and what they do (Chapter IV). Next we look at several chemical and physical phenomena which control the cell's environment: homeostasis, semi-permeable membranes, diffusion, diffusion pressure, osmosis, passive and active transport, turgor pressure, cytolysis, plasmolysis, and pinocytosis. (Chapter V)

Our consideration of the cell then takes us to major cellular processes, in particular, those involved in providing the energy necessary for life and those involved in coordinating the vast number of activities in the cell: photosynthesis, respiration, cell energy, DNA control of the cell, DNA coding, and protein synthesis. (Chapters VI & VII)

We consider how cells grow and how they reproduce so that we can better understand how organisms grow and reproduce and thereby insure that life is passed on from generation to generation. (Chapter VIII)

Finally, we will again consider what "life" is. We will consider two viewpoints: the vitalist, who considers life to be a spiritual force which causes living things to be alive, and the mechanist, who explains life in terms of chemical and physical principles and laws.

PEARL ③ UNIT GOALS & OBJECTIVES

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The Unit goals and objectives describe in somewhat more detail the course goals and objectives that will be taken up in the unit. The unit goals and objectives are general in nature. They will be described in behavioral terms in the chapter goals and objectives.

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      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ6R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"I have found unit goals and objectives to be a useful bridge between the course goals and objectives and those for the chapter. I find the course, unit and chapter goals and objectives essential for providing organized and meaningful learning experiences."

PEARL ④ OUTLINE CHAPTER

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

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      h. Graphic Aids
      i. SQ4R
      j. Calendar
      k. Student Guide and Checklist
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RATIONALE

The outline of the chapter can be done either to decide how the chapter is organized, mentally or on paper. Its purpose is to identify the important concepts in the text, to review how the author treats those concepts, to determine if all the concepts you think are important are covered by the author, and to identify those parts which will give at least some students difficulty.

TEACHER/STUDENT REACTION

"I overlooked this for so many years. Now that I am giving students prereading experiences and a study guide. I find I must look at the chapter critically, I must try to see the chapter through the eyes of the students. If I outline the chapter I must pick out topic sentences, main ideas, and supporting detail, just as they do. I am much better prepared to help them get meaning from the text."

Outline - Chapter 6

I. Energy and Life

A. All living cells must have a constant energy supply
  1. Energy source is glucose
  2. Energy in glucose comes from the sun

B. Compare Photosynthesis and Respiration
  1. Photosynthesis: a series of reactions in which light energy is changed into chemical energy and stored in glucose
  2. Respiration: a series of reactions in which cells break down glucose and release its stored energy.

C. Respiration goes on constantly in all living cells
Photosynthesis occurs only in certain green plant cells

II. The Importance of Photosynthesis

A. Only "self-fueling" cells make glucose
  1. All other organisms depend on these cells for energy - all life depends on photosynthesis
    a. direct: eat plants
    b. indirect: eat the animal that eats the plant

B If photosynthesis stopped, glucose would no longer be made
  1. sooner or later all food would run out and all life would end

C. Matter is recycled constantly
  1. simple molecules into complex, complex into simple

D. Energy is not recycled
  1. energy comes from the sun

III. The General Nature of Photosynthesis

A. photo = light; synthesis = build complex substance from simpler substances
  1. simple substance = $CO_2 + H_2O$

B. $6CO_2 + 6H_2O$ + light energy $\longrightarrow C_6H_{12}O_6 + 6O_2$

C. This is only a general idea of what happens.
  1. photosynthesis is actually a complex series of reactions

IV. The Role of Chlorophyll

A. Photosynthesis takes place only in the presence of chlorophyll

B. Chlorophyll is found in chloroplasts
  1. chlorophyll is a green pigment
  2. chlorophyll is packed between layer of proteins and lipids in discs called grana

C. Chlorophyll cannot develop without light

D. Chlorophyll acts as a catalyst

PEARL ⑤ CONCEPT MAP

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The purpose of a concept map is to show the relationships among all of the ideas to be learned in the chapter. The concept map will be important in structuring the learning strategy for the chapter. The concept map can also be modified as a structured overview and advanced organizer for students.

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  2. Motivation & Attention
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  4. Background
  5. Purpose Set
  6. Skill Review/Direction Review
- C. Activity
- D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"Does the text cover this subject completely? Do I need to supplement? What is the relationship between ideas? Which ideas need to be taken up before others? What am I assuming that students already know? Concept maps have been invaluable in working through this thicket of concerns."

PEARL (6) CHAPTER GOALS & OBJECTIVES

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

CLASSROOM ACTION PROGRAM

I. Course
  A. Course Philosophy
  B. Course Goals and Objectives
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    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

RATIONALE

Chapter goals & objectives will list the ideas the students will be expected to learn in this chapter. These goals and objectives will guide the student in his learning activities, such as reading assignments, class discussions, filmstrips and studying.

The list of activities presents all of the resources that are available for students to learn the goals and objectives.

TEACHER/STUDENT REACTION

"I find that the Objectives are very helpful because when I take a closer look at the chapter and the answers to the objectives it helps me to understand what the chapter is all about."

"They break your work up into comprenensible pieces."

"The objectives are helpful. They get to the point of your learning and I don't mess around with unimportant stuff."

"I think the P.C.'s are helpful because they help me remember things I might forget to study for the test."

Performance Criteria - Chapter 6: Photosynthesis, respiration & cell energy

1. Describe the role of photosynthesis and respiration in cell energy.
2. Compare photosynthesis and respiration.
3. Define photosynthesis.
4. Write a simplified chemical equation for photosynthesis.
5. Describe what the simplified chemical equation actually represent.
6. Describe what chlorophyll is.
7. Describe the organization of chlorophyll in lamellai, grana and chloroplasts.
8. Describe the function of chlorophyll in photosynthesis.
9. Define ATP, ADP.
10. Describe the general structure of ATP.
11. Describe how energy is absorbed and released by ATP.
12. Write a simplified chemical equation for photosynthesis when oxygen-18 is used.
13. Diagram the above equation to show where each atom on the left ends up on the right.
14. Describe the light reaction with respect to:
    a. how chlorophyll is energized.
    b. three way the energy in energized chlorophyll is trapped for use in the dark reactions.
    c. the role of NADP.
15. Describe the dark reactions with respect to:
    a. name the 3 parts of the cycle
    b. describe the important events of each part.
16. Describe the fate of PGAL
17. Describe what wavelengths (colors are used by chlorophyll
18. Define chemosynthesis, autotrophic, heterotrophic
19. Explain the process of respiration in terms of energy release.
20. Define oxidation; describe which kind of oxidation occurs in most cells.
21. Distinguish between aerobic and anaerobic respiration.
22. List the three stages of respiration (not in book).
23. Describe the steps of glycolysis.
24. Describe the steps of the citric acid cycle
25. Describe the steps of the respiratory enzyme chains
26. Write the general chemical equations for cellular respiration, alcoholic fermentation, and lactic acid fermentation.
27. Compare glycolsis, citric acid cycle, respiratory enzyme chain, cellular respiration, alcoholic fermentation and lactic acid fermentation with respect to energy production, i.e. how much ATP each produces.
28. Compare photosynthesis and respiration.

Activities

Lessons

1. Relationships between cell energy, photosynthesis, respiration.
2. ADP - ATP; Chloroplasts and chlorophyll
3. Photosynthesis: An overview; Details of the Light Reactions.
4. Details of the Dark Reactions.
5. Simplifying the Model; the Fate of PGAL.
6. A Summary Reaction; Light Absorption; Autotrophs & Heterotrophs Chemosynthesis & Photosynthesis.
7. Review
8. Test
9. Respiration Overview; Details of Glycolysis
10. Details of Citric Acid Cycle; Details of Respiratory Enzyme Chain.
11. A Simpler Model; A Summary Reaction.
12. A Simpler Model
13. Review.
14. Test.

Labs

1. The Role of Light and Chlorophyll in Photosynthesis (Stock #41)
2. Light and Leaves (BSCS #15-4)
3. Light Absorbed by Chlorophyll (Stock #48)
4. Separation of Chlorphyll Pigments by Paper Chromatography (Stock #45)
5. The Use of Carbon Dioxide by Green Plants in the Presence of Light (Stock #42)
6. A Method of Measuring Carbon Dioxide (Stock #43)
7. Green Plants Produce Gas During Photosynthesis (Stock #44)
8. Demonstration to Show that Glucose is Produced in a Green Leaf (Otto #6-2)
9. The Effect of Temperature Changes on Photosynthesis (Stock #46)
10. Intensity of Light and the Rate of Photosynthesis (Stock #47)
11. Effect of Various Visible Light Wave-lengths on the Growth of Green Plants (Otto #6-2, Part 5)
12. Oxygen Consumption in Respiration (Stock #34)
13. Carbon Dioxide Production in Respiration (Stock #35)
14. Energy Release in Cellular Respiration (Stock #36)

Filmstrips

1. ATP - A Packet of Energy
2. Chlorophyll: Capturing the Sun's Energy
3. Sugar Metabolism
4. Biochemistry of Enzyme Action
5. Chromatography in Biological Tool
7. Cell Nutrition
8. Cell Respiration
9.

Transparencies

1. Chemistry for Biology by Denoyer-Geppert
   21. Photosynthesis - A Cyclic Process
   22. Photosynthesis - Dark Reactions
   23. ADP - ATP: Universal Energy Currency
   24. Respiration
2. The Cell Amer. Cancer Soc.
   10. Chloroplasts and Grana

Project Slides

1. Understanding Photosynthesis

Micro-Slide Viewer

none

Prepared Biological Slides

none

Reading Assignments

1. pp. 85 - 88
2. pp. 88 - 95
3. pp. 95 - 101
4. pp. 101 - 105

Handouts

1. Objectives, Performance Criteria Activities.
2. Photosynthesis Steps; Chloroplast
3. Details of Photosynthesis.
4. A Simpler Model of Photosynthesis
5. Development of a General Reaction for Photosynthesis and Carbohydrate Synthesis
6. Respiration Steps
7. Details of Respiration
8. Development of General Reaction for Respiration
9. A Simpler Model for Respiration
10. A Simpler Model for Respiration

PEARL ⑦ TEST

CONTENT PRETEST

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

CLASSROOM ACTION PROGRAM

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  B. Course Goals and Objectives
  C. Unit Goals and Objectives
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    6. Learning Strategy
    7. Write Exercises
      a. Advanced Organizers
      b. Directed Reading Lessons
      c. Concept Development
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. KWH
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

RATIONALE

The content pretest will serve several purposes: a) the students will become aware of the content to be studied; b) the sutdents will find out what they will be expected to learn and how they will be expected to learn it; c) the students' confidence concerning the subject matter will be increased; and d) the teacher will learn how much the students know about the topic before instruction.

TEACHER/STUDENT REACTION

"I liked the pretest because I could see how much I had learned by comparing it to the final test."

MODERN BIOLOGY
CHAPTER SIX (Part 2)
PHOTOSYNTHESIS, RESPIRATION, AND CELL ENERGY

PRETEST

MULTIPLE CHOICE

1. The process responsible for the rising of bread is (a) cellular respiration because of the carbon dioxide produced; (b) fermentation because of the carbon dioxide produced; (c) anaerobic respiration when lactic acid is produced; (d) aerobic respiration when alcohol is produced.

2. The process responsible for the making of alcoholic beverages is (a) cellular respiration; (b) fermentation; (c) respiration to lactic acid; (d) all of these.

3. The process responsible for muscles getting tired after hard work is (a) cellular respiration; (b) fermentation; (c) respiration to lactic acid; (d) all of these.

4. The process responsible for providing energy to living organisms is (a) cellular respiration; (b) fermentation; (c) respiration to lactic acid; (d) all of these.

5. If a particular enzyme in the cell for one of the reactions of respiration is not made for some reason (a) photosynthesis will occur instead; (b) the respiration process stops; (c) a new kind of enzyme will take its place; (d) the respiration process will continue at a slower rate.

6. Which of the following has the greates amount of available energy per molecule? (a) ATP; (b) ADP; (c) H_2O; (d) CO_2.

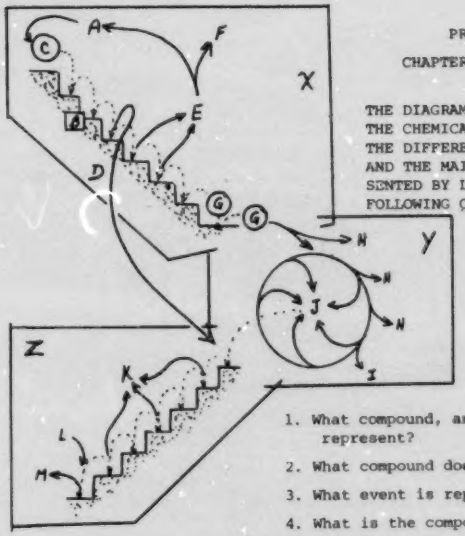
7. Chemical energy is released in which of the following? (a) DNA------RNA; (b) ATP-----ADP; (c) ADP------ATP; (d) RNA-----DNA.

8. Term referring to respiration with oxygen (a) airobic respiration (b) anaerobic respiration (c) citric acid cycle (d) NAD.

9. A term that means "glucose spitting". (a) ATP; (b) glycolysis; (c) NAD; (d) respiratory enzyme chain.

10. A high energy compound used in respiration. (a) enzyme; (b) NAD; (c) glucose; (d) ADP.

11. Which occurs during the day? (a) respiration; (b) photosynthesis; (c) both photosynthesis and respiration; (d) neither respiration nor photosynthesis.



PRACTICE TEST

CHAPTER SIX: PART TWO

THE DIAGRAM TO THE LEFT REPRESENTS THE CHEMICAL PROCESS OF RESPIRATION. THE DIFFERENT PARTS OF THE PROCESS AND THE MAIN COMPOUNDS ARE REPRESENTED BY LETTERS. ANSWER THE FOLLOWING QUESTIONS BASED UPON THIS DIAGRAM.

1. What compound, and how many, does C represent?
2. What compound does A represent?
3. What event is represented at B ?
4. What is the compound at A being used for?
5. What compound does D represent?
6. What compound does E represent?
7. What compound does F represent?
8. What compound does G represent?
9. What compound does H represent?
10. What compound does I represent?
11. What compound does J represent?
12. What compound does K represent?
13. What compound does L represent?
14. What compound does M represent?
15. What process is represented at X ?
16. What process is represented at y ?
17. What process is represented at Z?

PEARL 7

TEST

CONTENT PRACTICE TEST

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The content practice test provides students with an opportunity to review the content material before the chapter test. As a result of doing the practice test, students come back to class with review questions. It also reduces their anxiety concerning the chapter test.

CLASSROOM ACTION PROGRAM

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  B. Course Goals and Objectives
  C. Unit Goals and Objectives
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    3. Chapter Goals and objectives
    4. Write a Test
    5. Learning Strategy Worksheet
    6. Learning Strategy
    7. Write Exercises
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      b. Directed Reading Lessons
      c. Concept Development
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ4R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"From the practice test, I could find out how well I had studied. I also could find out what I didn't understand too well."

PEARL ⑦ TEST

BASIC LEARNING SKILLS PRETEST

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The basic learning skills pretest directs its attention to important skills that students will need to successfully complete the chapter. As a result of this pretest, the teacher will know which students have mastered the necessary skills, which students have satisfactory skills, and which students will need help and guidance.

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  C. Unit Goals and Objectives
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      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ4R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
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    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

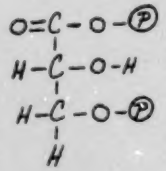
TEACHER/STUDENT REACTION

"The basic learning skill pretest was important to me in identifying students who needed to be targeted for special help if they were to understand the chapter."

UNDERSTANDING FORMULAS, EQUATIONS AND DIAGRAMS

What does each of the following symbols mean in the structural formula to the right?

1. O	A. calcium
2. ⊃	B. carbon
3. C	C. double bond
4. H	D. equal sign
5. -	E. helum
6. =	F. hydrogen
	G. minus sign
	H. oxygen
	I. phosphate group
	J. potassium



7. What is the molecular formula for the structural formula above?

: ——— :
: ——— :

8. Write a sentence that completely translates the chemical equation below.

$4\ Al + 3\ O_2 \longrightarrow 2\ Al_2O_3$

aluminum *oxygen* *aluminum oxide*

: ——— :
: ——— :

9. In the example chemical equations below, what does ⟶ mean?

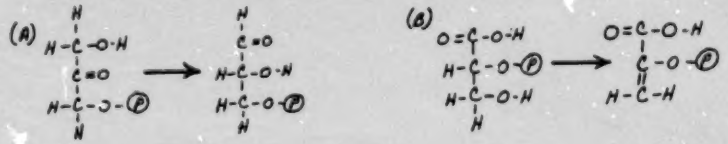
10. In the example chemical equations below, what does ⇌ mean?

Compound A ⟶ Compound B Compound Y ⇌ Compound Z

: ——— :
: ——— :

11. In chemical change (A) below, (a) the molecule was rearranged, (b) a molecule was removed; (c) a molecule was added; (d) no change occurred.

12. In chemical change (B) below, (a) the molecule was rearranged, (b) a molecule was removed; (c) a molecule was added; (d) no change occurred.

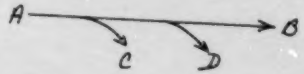


CHOOSE THE DIAGRAM FROM THE NEXT PAGE THAT WOULD BEST ILLUSTRATE EACH OF THE FOLLOWING SITUATIONS.

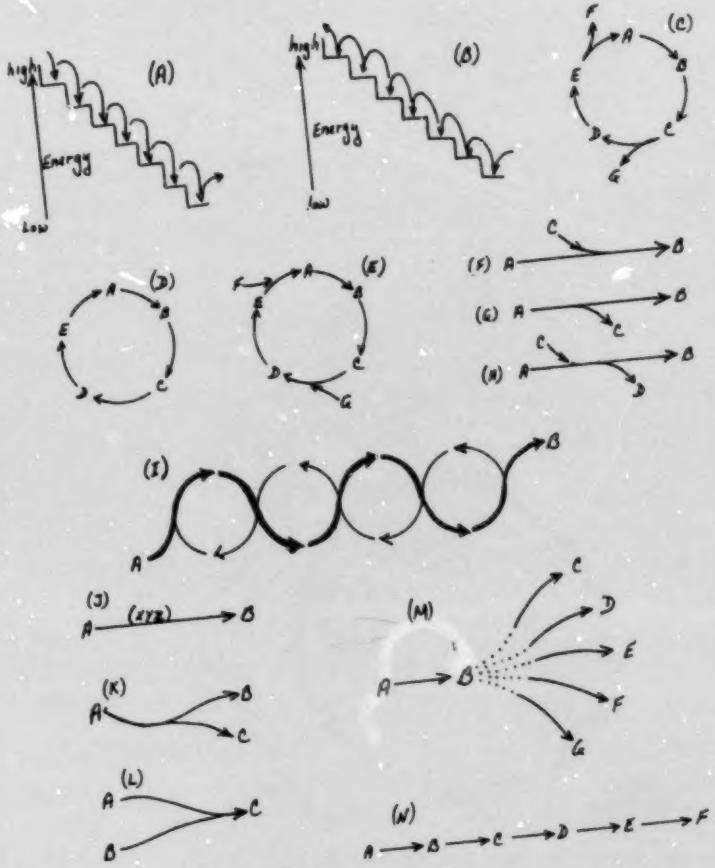
13. A compound or condition is needed to change one compound into another but that compound or condition is not involved in the change of the molecular formula.
14. A chain of cyclic reactions.
15. Several different possible products from a compound.
16. A series of reactions beginning with a compound with high chemical energy and ending with a compound with low chemical energy.
17. A series of reactions beginning with a compound with low chemical energy and ending with a compound with high chemical energy.
18. A compound is split into two more or less equal products.
19. Two more or less equal compounds are joined into one product.
20. A series of reactions that produces a cycle where the last product begins the cycle over again.
21. A compound is added to a cycle of reactions.
22. A product is produced by a cycle of reactions.
23. A chemical change in which a molecule is added to a compound to produce a new compound.
24. A chemical change in which a molecule is removed from a compound to produce a new compound.
25. A chemical change in which a molecule is added and another removed to produce a new compound.

THE FOLLOWING PARAGRAPH CAN BE REPRESENTED BY A DIAGRAM. COMPLETE THE DIAGRAM BASED UPON THE INFORMATION IN THE PARAGRAPH.

"First, two hydrogen atoms and one carbon dioxide molecule are removed from each pyruvic acid molecule. Two acetic acid molecules result. The carbon dioxide is released."



26. What does A represent?
27. What does B represent?
28. What do C and D represent?



PEARL ⑦ TEST

CONTENT POSTTEST

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

CLASSROOM ACTION PROGRAM

I. Course
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      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ4R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

RATIONALE

The content posttest evaluates the students' achievement on the objectives that were set down for the chapter. This test should be comprehensive, containing questions on each objective.

TEACHER/STUDENT REACTION

"The objectives and test provide a goal toward which student learning and classroom activities can be directed in a well organized fashion."

MODERN BIOLOGY TEST:
CHAPTER SIX (Part 2):
PHOTOSYNTHESIS, RESPIRATION, AND CELL ENERGY

1. Write the general equation for cellular respiration.
2. Write the general equation for alcoholic fermentation.
3. Write the general equation for anaerobic respiration to lactic acid.

MULTIPLE CHOICE

4. Each step of the respiration process requires (a) energy from sunlight; (b) energy from ATP; (c) an enzyme; (d) the gas carbon dioxide.

5. The general equations for anaerobic and areobic respiration represent (a) a complex set of reactions; (b) a simple one-step process; (c) reactions that can only be done in the scientists lab; (d) a simple three-step process.

6. The process responsible for the rising of bread is (a) cellular respiration because of the carbon dioxide produced; (b) fermentation because of the carbon dioxide produced; (c) anaerobic respiration when lactic acid is produced; (d) aerobic respiration when alcohol is produced.

7. The process responsible for the making of alcoholic beverages is (a) cellular respiration; (b) fermentation; (c) respiration to lactic acid; (d) all of these.

8. The process responsible for muscles getting tired after hard work is (a) cellular respiration; (b) fermentation; (c) respiration to lactic acid; (d) all of these.

9. The process responsible for providing energy to living organisms is (a) cellular respiration; (b) fermentation; (c) respiration to lactic acid; (d) all of these.

10. If a particular enzyme in the cell for one of the reactions of respiration is not made for some reason (a) photosynthesis will occur instead; (b) the respiration process stops; (c) a new kind of enzyme will take its place; (d) the respiration process will continue at a slower rate.

11. A basic function of enzymes in the cell is to (a) increase the rate of chemical reactions; (b) produce energy-releasing substances; (c) decrease the random motion of molecules; (d) provide energy to link molecules together.

12. Enzymes have the following effect within cells. Enzymes (a) increase or decrease rates of reactions; (b) do not affect rates of reactions; (c) supply necessary amino acids; (d) supply the energy necessary to carry out all reactions.

13. Enzymes involved in chemical reactions (a) are used up; (b) are decomposed; (c) react more rapidly as the reaction progresses; (d) are not used up.

NAME_____

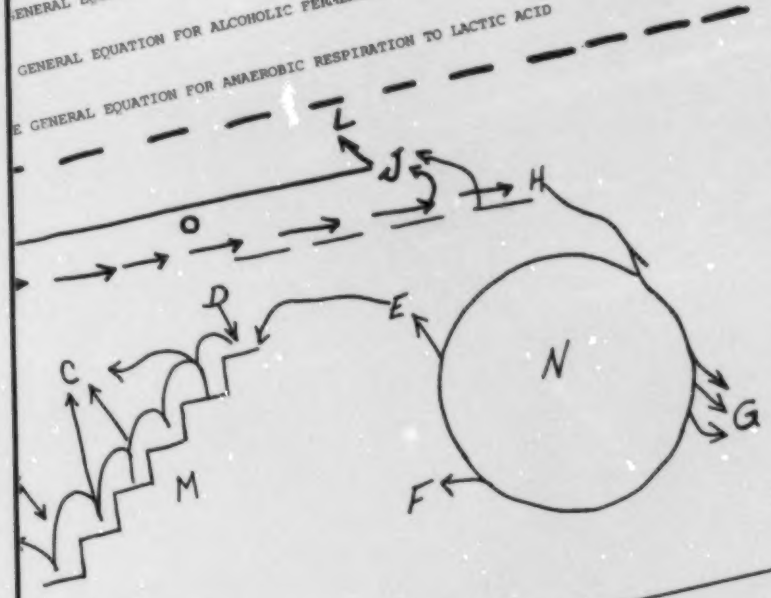
...IRATION, & CELL ENERGY

21.____	31.____	41.____	51.____	61.____	71.____
22.____	32.____	42.____	52.____	62.____	72.____
23.____	33.____	43.____	53.____	63.____	73.____
24.____	34.____	44.____	54.____	64.____	74.____
25.____	35.____	45.____	55.____	65.____	75.____
26.____	36.____	46.____	56.____	66.____	76.____
27.____	37.____	47.____	57.____	67.____	77.____
28.____	38.____	48.____	58.____	68.____	78.____
29.____	39.____	49.____	59.____	69.____	79.____
30.____	40.____	50.____	60.____	70.____	

...ENERAL EQUATION FOR CELLULAR RESPIRATION.

GENERAL EQUATION FOR ALCOHOLIC FERMENTATION.

E GENERAL EQUATION FOR ANAEROBIC RESPIRATION TO LACTIC ACID



...ead rapidly. This is different from
... (a) no heat is produced; (b) no
...id burning; (d) the reaction is con-

...ns below. Write the letter of
...ank on the answer sheet. The
...gram on your answer page and

...6 O_2 (oxygen)
photosynthesis
photolysis
pyruvic acid
...espiratory enzyme
chain
...litting glucose
...rter energy
...ight

...G represent?
...E represent?
... represent?
... represent?
...ented at A?
...ented at B?
...ented at C?

(b) are
...informa-
...parated

...rogen

...ule?

...t gain of 4 hydrogens;
...et gain of 2 ATP; (d) there

...n dioxide; (b) carbon dioxide
...(e) glucose.

...rbon dioxide and water;
...

...rbon dioxide and water;
...e.

...enzyme chain; (b) glycolysis;

...hain; (b) glycolysis; (c) citric

...in; (b) glycolysis; (c) citric

...tion is produced (a) when oxygen
...ve hydrogen from glucose;
...oxygen is present.

...ng to respiration with oxygen.
...ng to respiration without oxygen.
... means "glucose spitting".
...riphosphate.
...iphosphate.
...rgy compound used in respiration.
...or each and every reaction of either
...n or photosynthesis.
...h carrier which carries hydrogen to the
...ry enzyme chain.
...he rate of a reaction without being
...y the reaction.
... of enzymes which produce ATP by passing
... pairs from one enzyme to another.

...n energy compound is broken into carbon

...gh-energy compound is split in two while

...e source of energy in the cell.
...sary to make this compound when oxygen is

...lls and can produce carbon dioxide and ethyl

...ced in aerobic glycolysis
...any associated respiratory
...uced in anaerobic respiratio
...uced in aerobic respiration?
...uced by the citric acid cyc
...duced by the respiratory enz

...duced by the citric acid cyc
...tory enzyme chains?

...occurs only in the day?
...occurs only at night?
...occurs during the day?
...occurs during the night
... occurs only in plants?
... occurs only in animals?
... occurs in plants?
... occurs in animals?
...h requires chlorophyll?
...h occurs in chloroplasts?
...h occurs in mitochondria?
...ch occurs with the aid of
...ch uses oxygen?
...ch produces oxygen?
...ich produces carbon dioxid
...ich uses carbon dioxide?
...ich uses water?
...hich produces water?
...hich converts the energy
...chemical energy?
...hich converts the energy
... useable energy in ATP?

39

40

PEARL ⑦ TEST

BASIC LEARNING SKILLS POSTTEST

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The basic learning skills posttest evaluates the progress students have made toward achieving the skills that were emphasized in the particular chapter.

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         e. Content Aids
         f. Critical Thinking
         g. Vocabulary
         h. Graphic Aids
         i. SQ4R
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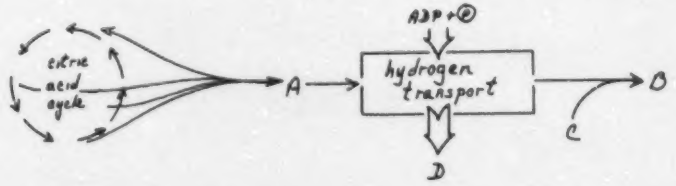
      4. Background
      5. Purpose Set
      6. Skill Review/Direction Review
   C. Activity
   D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

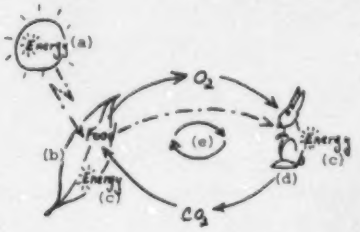
"The results of the basic learning skills posttest not only allow me to find out how students are doing in developing their skills, but it also lets me know how effective the lessons were."

THE FOLLOWING PARAGRAPH CAN BE REPRESENTED BY A DIAGRAM. COMPLETE THE DIAGRAM BASED UPON THE INFORMATION IN THE PARAGRAPH.

"Hydrogen is also released during the citric acid cycle. This hydrogen is involved in a series of reactions call hydrogen transport. During these reactions, energy is stored in ATP formed from ADP. Finally, the hydrogen atoms combine with oxygen and form water."



29. What does A represent?
30. What does B represent?
31. What does C represent?
32. What does D represent?



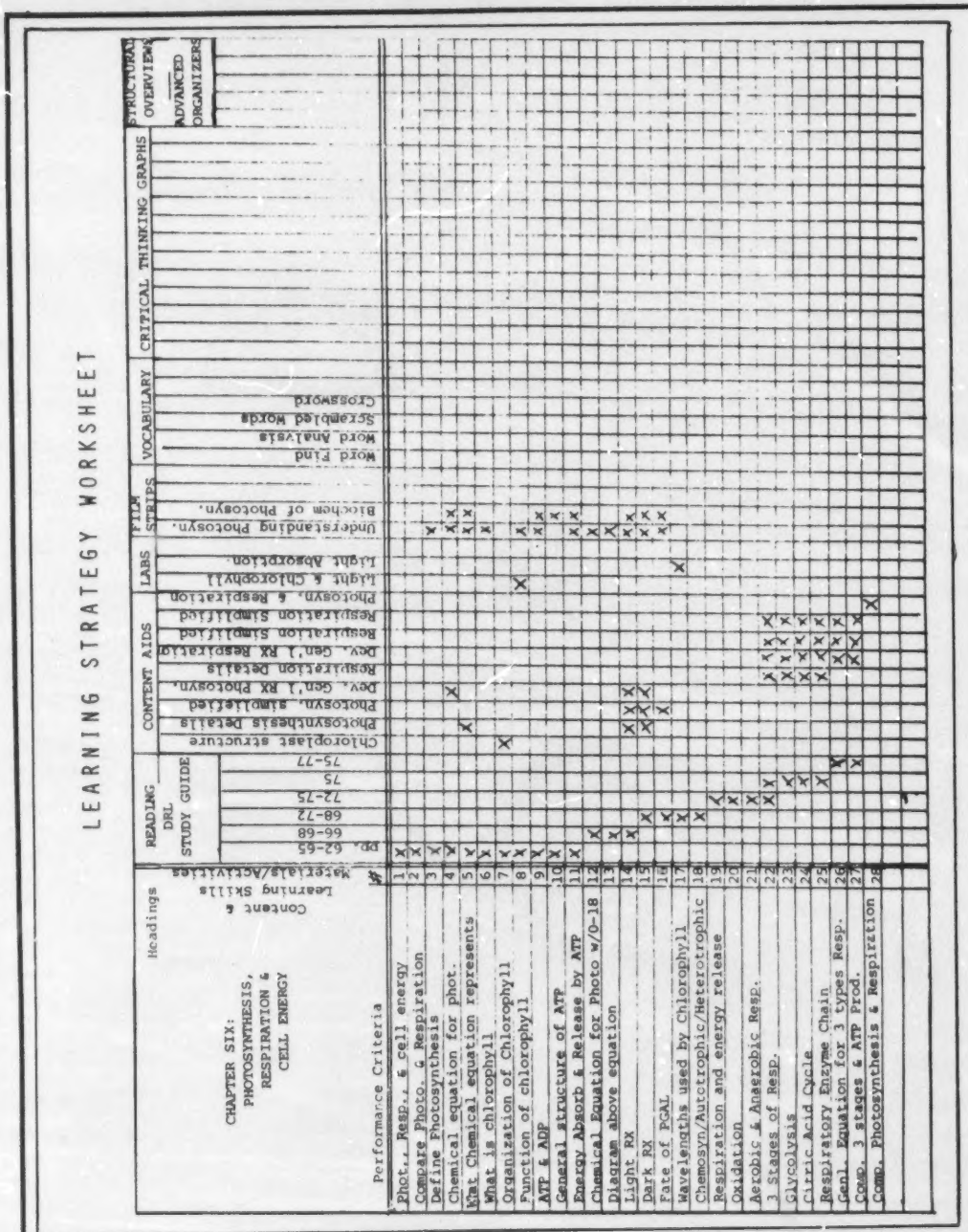
THE FOLLOWING IDEAS ARE REPRESENTED IN THE DIAGRAM TO THE LEFT. USE THE LETTERS (a, b, c, d, e) TO INDICATE THE PART OF THE DIAGRAM REFERRED TO BY EACH OF THE FOLLOWING STATEMENTS:

33. represents green plants
34. represents the animal kingdom
35. represents the source of energy used by living things
36. represents the natural cycle of gases in the living world
37. represents energy needed for life activities

TRUE OR FALSE (According to the diagram):

38. plants use sunlight energy to make a high-energy food
39. animals get their energy directly from the sun
40. the high-energy food provides energy for life activities
41. plants produce oxygen while animals use carbon dioxide
42. plants use carbon dioxide while animals use oxygen

43. and 44. This diagram tell two main ideas. What are these two ideas?



PEARL 8 LEARNING STRATEGY WORKSHEET

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The learning strategy worksheet will assist the teacher in coordinating content goals and objectives, basic learning skills, and classroom activities so that the most effective learning strategy can be developed.

CLASSROOM ACTION PROGRAM

I. Course
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- C. Unit Goals and Objectives

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     - d. Study guide
     - e. Content Aids
     - f. Critical Thinking
     - g. Vocabulary
     - h. Graphic Aids
     - i. PQRST
     - j. Calendar
     - k. Student Guide and Checklist
- B. Student Preparation
  1. Orientation/Introduction
  2. Motivation & Attention
  3. Vocabulary/Clarification of Concepts
  4. Background
  5. Purpose Set
  6. Skill Review/Direction Review
- C. Activity
- D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"How am I going to help all my students, whether slow, average or talented, learn a particular idea? Clearly described learning strategies have been a great help in achieving effective plans of attack."

PEARL ⑨ LEARNING STRATEGY

HIGHLIGHTED SKILLS

Teacher Preparation Phase of Directed Learning Activity

RATIONALE

The Learning Strategy will describe approaches that can be used to assist students in learning the objectives. The learning strategy attempts to provide the most effective combination of content objectives, basic learning skills, and classroom activities for each student.

CLASSROOM ACTION PROGRAM

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      b. Directed Reading Lessons
      c. Concept Development
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ4R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Rev ew/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

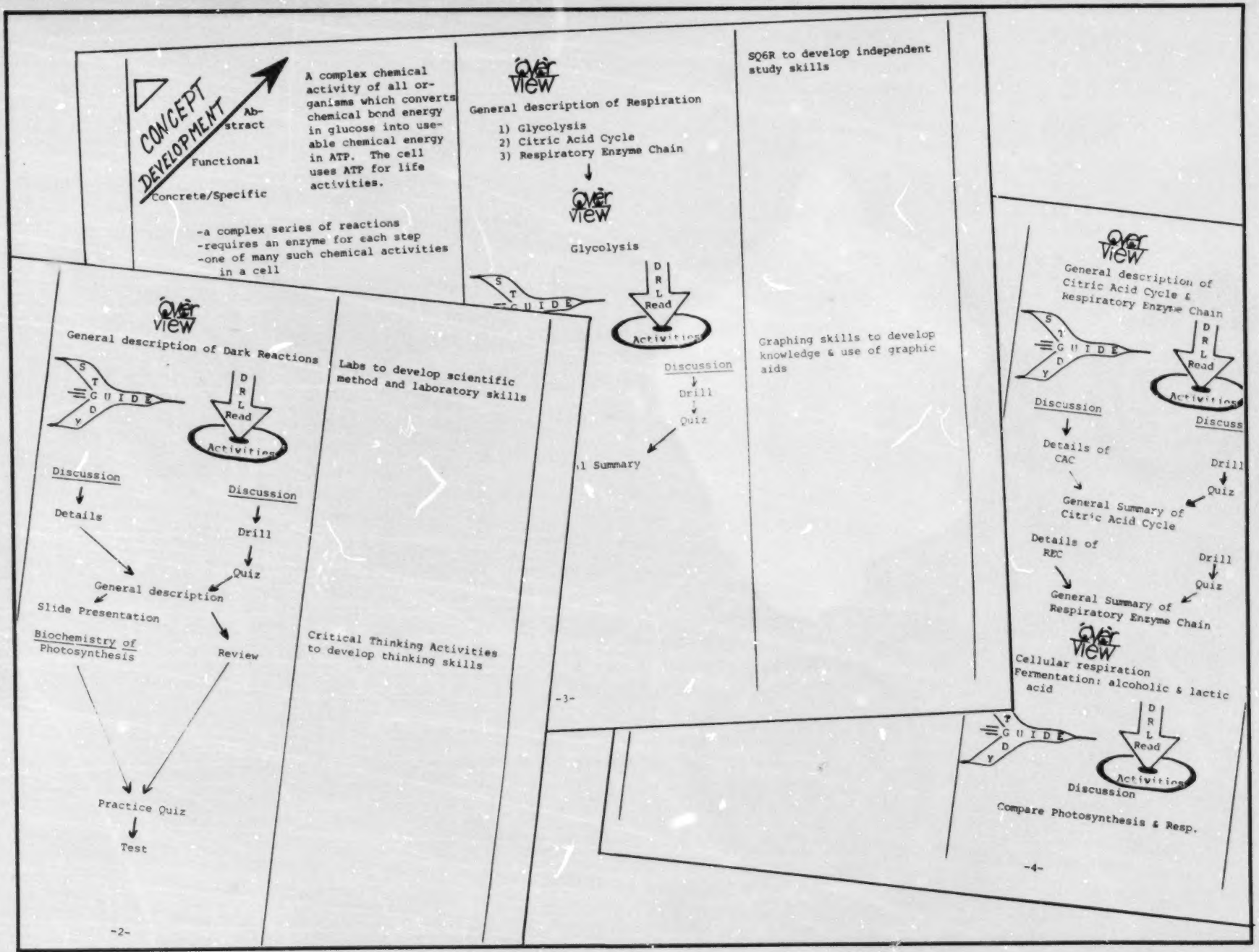
TEACHER/STUDENT REACTION

"How am I going to help all my students, whether slow, average, or talented, to learn a particular idea? Clearly described learning strategies have been a great help in achieving effective plans of attack."

LEARNING STRATEGY

NOTES	STRATEGY	PARALLEL ACTIVITIES
Concept Development: The concept of Photosynthesis: A complex chemical activity of plants which traps radiant energy from the sun and coverts it to chemical bond energy in glucose. CONCEPT DEVELOPMENT Abstract Functional Concrete/Specific -a complex series of reactions -requires enzymes for each step -one of many such chemical activities. Take up photosynthesis in depth with better students and spend more time in basic activities and quizzing with others.	Overview of Photosynthesis, Respiration, Energy & Life S T G I D E D R L Read Activities Discussion Get a VIEW General description of Light Reactions Discussion Overview & Reading Discussion Drill Quiz Details General Description	Paper Labs to develop scientific method and thinking skills Vocabulary puzzles to help develop vocabulary

-1-


CONCEPT DEVELOPMENT
Abstract
Functional
Concrete/Specific
A complex chemical activity of all organisms which converts chemical bond energy in glucose into useable chemical energy in ATP. The cell uses ATP for life activities.
-a complex series of reactions
-requires an enzyme for each step
-one of many such chemical activities in a cell
OVERVIEW
General description of Dark Reactions
STUDY GUIDE
DRL Read
Activities
Discussion
Details
Discussion
Drill
Quiz
General description
Slide Presentation
Biochemistry of Photosynthesis
Review
Practice Quiz
Test
-2-
Labs to develop scientific method and laboratory skills
Critical Thinking Activities to develop thinking skills
OVERVIEW
General description of Respiration
1) Glycolysis
2) Citric Acid Cycle
3) Respiratory Enzyme Chain
OVERVIEW
Glycolysis
STUDY GUIDE
DRL Read
Activities
Discussion
Drill
Quiz
l Summary
-3-
SQ6R to develop independent study skills
Graphing skills to develop knowledge & use of graphic aids
OVERVIEW
General description of Citric Acid Cycle & Respiratory Enzyme Chain
STUDY GUIDE
DRL Read
Activities
Discussion
Discuss
Details of CAC
Drill
Quiz
General Summary of Citric Acid Cycle
Details of REC
Drill
Quiz
General Summary of Respiratory Enzyme Chain
OVERVIEW
Cellular respiration
Fermentation: alcoholic & lactic acid
STUDY GUIDE
DRL Read
Activities
Discussion
Compare Photosynthesis & Resp.
-4-

PEARL (10) ADVANCED ORGANIZERS STRUCTURAL OVERVIEWS

HIGHLIGHTED SKILLS

Comprehension	Rate of Study
Vocabulary	Graphic Aids
Evaluate Material	Organize & Summarize

RATIONALE

An advanced organizer is a pre-learning activity. It sums up the content of an activity and prepares the student so that he can successfully complete it. Advanced organizers may take the form of a summary, a study guide, a series of questions, cartoons, or overviews that will note the author's purpose and plan of presentation, explain major concepts, provide synonyms for difficult words, or paraphrase difficult text.

Structural Overviews are diagrams of the content that serve as advanced organizers and prepare the student for the activity.

CLASSROOM ACTION PROGRAM

I. Course
  A. Course Philosophy
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  C. Unit Goals and Objectives
II. The Directed Learning Activity
  A. Teacher Preparation
    1. Outline Chapter
    2. Concept Map
    3. Chapter Goals and objectives
    4. Write a Test
    5. Learning Strategy Worksheet
    6. Learning Strategy
    7. Write Exercises
      a. Advanced Organizers
      b. Directed Reading Lessons
      c. Concept Development
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ4R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"These are helpful because it lets us know what we're getting into. We don't go into the assignment blindly."

"The overviews are for me the most helpful thing that every teacher can do. I like it because it makes it easier for me to understand the chapter."

"It is very helpful to know ahead of time what we are going to learn in the chapter."

LIFE here on earth depends on the flow of energy from thermonuclear reactions taking place at the heart of the sun. The amount of radiant energy delivered by the sun to the earth is 13×10^{23} (the number 13 followed by 23 zeros) calories per year.

1,300,000,000,000,000,000,000 CALORIES

This number is certainly hard to imagine!

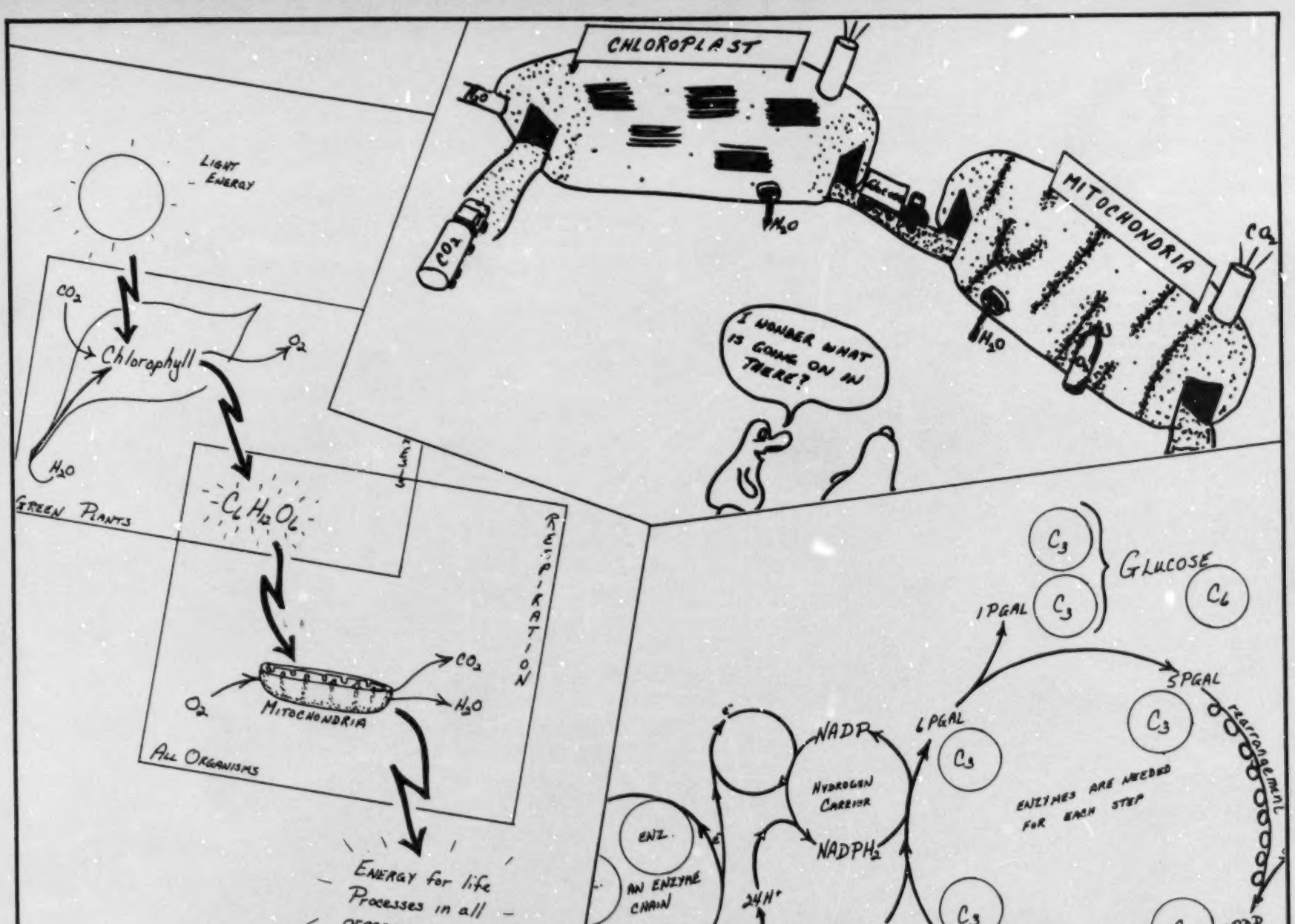
For example, the amount of energy striking the earth every day is the equivalent of about 1 million Hiroshima-sized atomic bombs.

About a third of this solar energy is immediately reflected back into space as light (just as light is from the moon.

Much of the remaining two-thirds is absorbed by the earth and converted to heat. Some of this absorbed heat warms the earth's surface, bodies of water, and air. Some serves to evaporate the waters of the oceans, producing the clouds that, in turn, produce rain and snow. Solar energy, in combination with other factors, is also responsible for the movements of air and water that help set up weather patterns all over the surface of the earth.

Less than 1 percent of the solar energy that reaches the earth is processed by green plants. Green plants convert the solar energy into the chemical energy that will drive nearly all the processes of life. Living systems change energy from one form to anotner, changing the energy of the sun into the chemical energy used by living organisms.

The energy you and all organisms need to stay alive, and the energy from wood, coal, gasoline and oil, comes from the sun through the action of green plants.


CHLOROPLAST
MITOCHONDRIA
LIGHT ENERGY
CO_2
Chlorophyll
O_2
H_2O
$C_6H_{12}O_6$
GREEN PLANTS
RESPIRATION
MITOCHONDRIA
ALL ORGANISMS
ENERGY for life Processes in all organisms.
I WONDER WHAT IS GOING ON IN THERE?
GLUCOSE
1PGAL
3PGAL
NADP
NADPH₂
HYDROGEN CARRIER
ENZ.
AN ENZYME CHAIN
CHLOROPHYLL
24H⁺
1ATP
1PGA
ENZYMES ARE NEEDED FOR EACH STEP
REARRANGEMENT
3RDP

PEARL ⑪ DIRECTED READING LESSON

HIGHLIGHTED SKILLS

Comprehension	Rate of Study
Vocabulary	Graphic Aids
Evaluate Material	Organize & Summarize
Use of Time	SQ6R

RATIONALE

The Directed Reading Lesson is a teacher-directed strategy that ensures success when a student performs a reading assignment. It consists of four parts. The preparation component provides the learner with just enough information to enable the student to read, think, and learn with success. The reading component may be silent, independent reading. If the student has difficulty with this skill, provide training by providing reading and/or reasoning guides. The third part is discussion and comprehension check. The teacher probes with questions to determine if student obtained the appropriate meaning from the reading. Finally, follow-up activities, can be used to reinforce comprhension, and to extend understanding.

CLASSROOM ACTION PROGRAM

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II. The Directed Learning Activity
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    2. Concept Map
    3. Chapter Goal's and objectives
    4. Write a Test
    5. Learning Strategy Worksheet
    6. Learning Strategy
    7. Write Exercises
      a. Advanced Organizers
      b. Directed Reading Lessons
      c. Concept De [illegible]
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ6R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"My major frustration has been that students have not been able to learn from reading assignments. Now I have the answer - directed reading lessons!"

DIRECTED READING LESSON

Chapter 6: Photosynthesis, Respiration, and Cell Energy

Assignment: Read pages 62 - 67

Objectives: Performance Criteria 1 to 13

I. Preparation

A. Introduction and Motivation

1. Advanced Organizer - reading on energy from the sun
2. Structural Overview - overview of relationships between sun, photosynthesis, respiration, ATP and cell energy.

B. Concept Clarification

Most sources of energy on earth can be traced back to the sun. List on the blackboard any sources of energy students can think of and show how all except atomic energy can be traced back to the sun, and most via green plants and photosynthesis. This concept is reinforced by the advanced organizer, structural overview, and the discussion in the book.

C. Word Stoppers

Photosynthesis	1. Structural Analysis
Respiration	2. Word Find
Chlorophyll	3. Definition
Chloroplast	4. Crossword
Grana	5. Advanced organizer, structural overviews, drawings, and pictures
ATP	
ADP	

D. Skill Direction

Study Guide - Go over study guide to make sure all students know what to do.

E. Purposes for Reading

Answer objectives 1 to 13

II. Reading

III, Comprehension Check

A. quiz B. class discussion C. check study guide sheets

CONCEPT DEVELOPMENT - RESPIRATION

PERCEPTUAL
Actual experience with the concrete

What does respiration mean to you?
"breathing" - "take in oxygen & give off CO_2"
What about a tree? Does a tree have respiration?
"gives off O_2" - "takes in carbon dioxide"
What about a fish? Does a tree breath? respire?
"a fish doesn't breath like land animals, it uses gills."

Does respiration mean "breathing"? Let's look a little further.

How is the word used in common usage English?
"respiration rate" - "artifical respiration" - "respiration machine"

The word still seems mean "breathing" - "taking in oxygen and giving off carbon dioxide.

Let's look further.

DIFFERENCES
What respiration is not

Why do we need oxygen?
"to breath"
Do we need oxygen to breath or do we breath because we need oxygen?
"breath because we need oxygen"

So if what our text says is true, "organisms need oxygen for respiration", the book does not mean that respiration is breathing.

CONTEXTUALIZE

Why do we need oxygen?
"for our blood" - "for our heart" - "for our brain" etc.

What would happen is I put a tourniquet around my wrist?
"your hand would turn blue" -"Your hand would die"
Why?
"no blood"
What does the blood have that the cells of my hand need?
"oxygen & food"
Why do the cells need oxygen?
? ? ? ? ? ? ? ?
What process outside the living world requires oxygen.
"fire"
What is fire? How do we classify it? It is a form of ____?
"energy"
Can you tell me now why the cells of my hand need oxygen?
My cells need oxygen, you told me. Fire needs oxygen.
Fire is a form of energy.
"the cells need oxygen for energy."

PEARL (12) CONCEPT DEVELOPMENT

HIGHLIGHTED SKILLS

Comprehension
Vocabulary

RATIONALE

Major Concept should be identified and special attention should be paid to their development. Concept development proceeds through several levels in the mind of the learner. For the most part a learner must proceed through these levels in proper sequence. The teacher must take this into consideration when planning learning activities.

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      c. Concept Development
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ6R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"Concept development really works! I've had marvelous success in helping students begin with concrete and specific examples and in working toward more abstract and general meanings."

PEARL (13) STUDY GUIDE

HIGHLIGHTED SKILLS

Comprehension	Rate of Study
Vocabulary	Graphic Aids
Evaluate Material	Organize & Summarize

CLASSROOM ACTION PROGRAM

I. Course
- A. Course Philosophy
- B. Course Goals and Objectives
- C. Unit Goals and Objectives

II. The Directed Learning Activity
- A. Teacher Preparation
  1. Outline Chapter
  2. Concept Map
  3. Chapter Goals and objectives
  4. Write a Test
  5. Learning Strategy Worksheet
  6. Learning Strategy
  7. Write Exercises
     - a. Advanced Organizers
     - b. Directed Reading Lessons
     - c. Concept Development
     - d. Study guide
     - e. Content Kits
     - f. Critical Thinking
     - g. Vocabulary
     - h. Graphic Aids
     - i. SQ6R
     - j. Calendar
     - k. Student Guide and Checklist
- B. Student Preparation
  1. Orientation/Introduction
  2. Motivation & Attention
  3. Vocabulary/Clarification of Concepts
  4. Background
  5. Purpose Set
  6. Skill Review/Direction Review
- C. Activity
- D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"I think the study guides are a great help in finding the correct ideas. They also help a person study. I wish the other teachers would do the same."

"Of all of the activities, the ones I found most helpful and liked the most were the study guides. They helped me understand what the paragraphs from the reading were all about."

RATIONALE

The study guide is to be used with reading assignments. The teacher has made a detailed analysis of the reading material and has identified those parts which are likely to give students difficulty. Through the reading guide the teacher provides any guidance and additional information needed to extract important ideas from the chapter.

STUDY GUIDE - CHAPTER SIX

Photosynthesis, Respiration & Cell Energy

Begin a new page in your notebook. Write the title of the chapter at the top of the page. In this chapter there will be 22 Reading Direction (RD) questions. You will answer the 23 RD questions on this first page. Begin answering the performance criteria on the next page.

ENERGY & LIFE

Page 62 — Look 6-1

Note: "All living things must have a constant supply of energy." What do Photosynthesis & Respiration have to do with providing this cell energy?

Para. 1 — YIELD P.C. #1

para. 2 — YIELD P.C. #2

Para. 3

In your notes, make two headings [illegible] ompare photosynthesis and respiration [illegible] nber that comparison me[illegible] ways [illegible] he alike and diffe[illegible]

THE IMPORTANCE [illegible]ANS PHOSYNTHOUND

para. 4

para. 5

RD 2. Why is an energy transfer compound necessary?

65

YIELD P.C. #9

[illegible]ra. T

para. 1

RD 3. What is the main idea of paragraph 1?

a. describes where ATP is organized and released
b. describes the structure of ATP
c. describes the composition of adenine
d. describes how quickly ATP can change to share or release energy.

YIELD P.C. #10

para. 2

Look 6.5

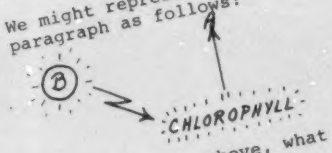
para. 3 — YIELD P.C. #11

The diagram on the next page will help alot in understanding this paragraph.

TIONS

Keep referring to page 69 as you read.

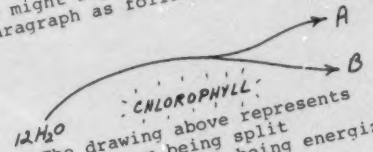
We might represent the information in this paragraph as follows:



RD 9. In the drawing above, what do A and B represent?

at A?_____ a. chlorophyll
b. electrons raised to a higher energy level
at B?_____ c. light

We might represent the information in this paragraph as follows:

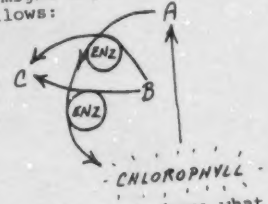


RD 10. a. The drawing above represents
a. water being split
b. chlorophyll being energized
c. photosynthesis
d. strong bonds

b. In the drawing above, what do A and B represent?
a. water and carbon dioxide
b. ADP and ATP
c. oxygen and hydrogen
d. chlorophyll and energized electrons

READ: The ATP discussed in this paragraph is made from ADP and Phosphate through the help of an enzyme chaine. The energized electrons (mentioned in the first paragraph on this page) are taken by an enzyme and passed from enzyme to enzyme. These enzymes use the energy in the energized electrons to make ATP from ADP and Phosphate. When all of the energy in the energized electrons is used up, the electrons return to chlorophyll.

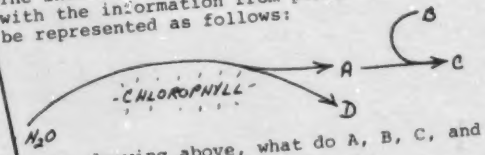
We might represent this information as follows:



1. In the drawing above what do A, B, and C represent?

at A?_____ a. light
b. oxygen
at B?_____ c. ADP
d. ATP
at C?_____ e. water
f. energized electrons

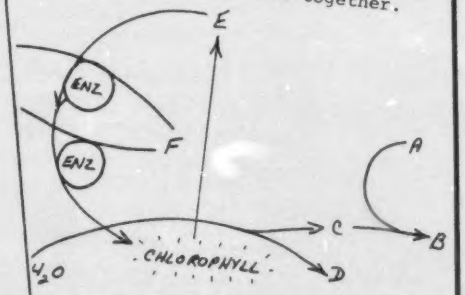
The information in this paragraph together with the information from paragraph 1 can be represented as follows:



n the drawing above, what do A, B, C, and represent?

at A?_____ a. oxygen
b. water
at B?_____ c. NADP
d. $NADPH_2$
at C?_____ e. excited electrons
f. chlorophyll
at D?_____ g. hydrogen
h. light

Now lets put it all together.



In the drawing above, what do A, B, C D, E, F, and G represent?

at A?_____ a. water
b. hydrogen
at B?_____ c. oxygen
d. ADP
at C?_____ e. ATP
f. light
at D?_____ g. NADP
h. $NADPH_2$
at E?_____ i. excited electrons
j. enzymes
at F?_____ k. chlorophyll
at G?_____ l. splitting of water

PEARL ⑭ CONTENT AIDS

HIGHLIGHTED SKILLS

Supplementary to Content

RATIONALE

The teacher provides any necessary readings, drawings, exercises and activities that are needed to obtain information from the chapter.

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  - 3. Chapter Goals and objectives
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  - 6. Learning Strategy
  - 7. Write Exercises
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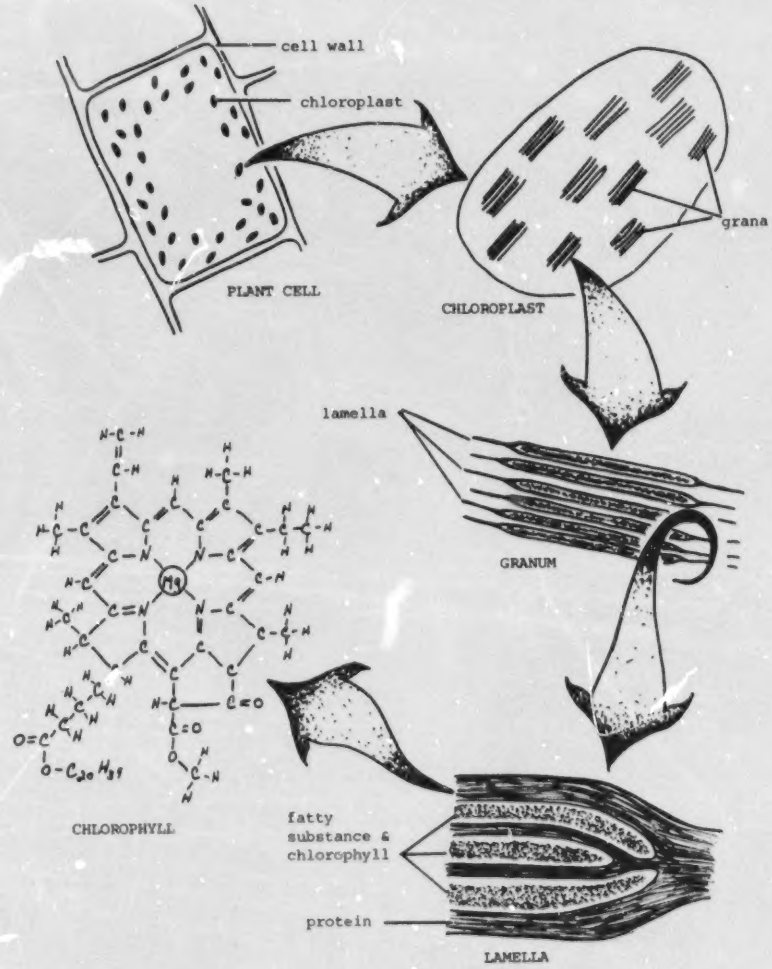
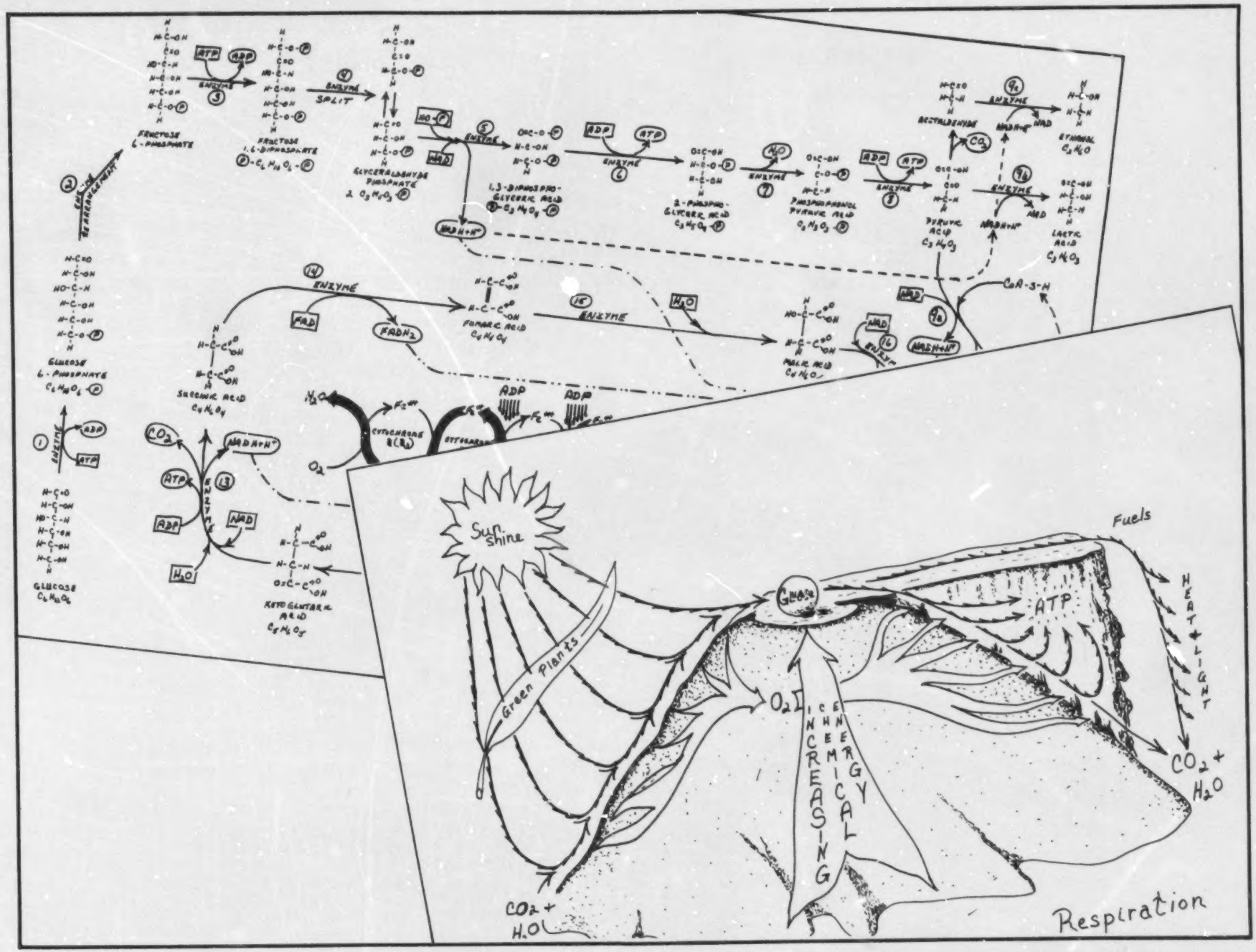
    - b. Directed Reading Lessons
    - c. Concept Development
    - d. Study guide
    - e. Content Aids
    - f. Critical Thinking
    - g. Vocabulary
    - h. Graphic Aids
    - i. SQ4R
    - j. Calendar
    - k. Student Guide and Checklist
- B. Student Preparation
  - 1. Orientation/Introduction
  - 2. Motivation & Attention
  - 3. Vocabulary/Clarification of Concepts
  - 4. Background
  - 5. Purpose Set
  - 6. Skill Review/Direction Review
- C. Activity
- D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"So often I know of a better way to explain something than what is in the book. Supplementary content materials are essential."




Sunshine
Fuels
Green Plants
Glucose
ATP
HEAT + LIGHT
O_2
INCREASING CHEMICAL ENERGY
CO_2 + H_2O
CO_2 + H_2O
Respiration

PEARL (15) THINKING SKILLS

HIGHLIGHTED SKILLS

Comprehension

RATIONALE

A variety of exercises are provided to help students improve their skills in thinking and reasoning.

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  C. Unit Goals and Objectives
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    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"I thought the thinking skills were very helpful because they let me use my head."

"I like the thinking problems because they were a lot of fun to do, and they really make you think."

Figure out the pattern then write the next 3 terms in the series.

1. 1, 2, 6, 24, 120, ___, ___, ___

2. 15, 20, 13, 18, 11, ___, ___, ___

3. 0, 0, 4, 9, 8, 18, 12, 27, ___, ___, ___

4. 2, 3, 5, 8, 9, 11, 14, 15, ___, ___, ___

5. 3, 4, 6, 11, 12, 14, 20, 21, 23, 30, ___, ___, ___

6. 1, 4, 9, 16, 25, ___, ___, ___

7. 1, 8, 27, 64, 125, ___, ___, ___

8. 1, 2, 2, 6, 3, 12, 4, 20, 5, ___, ___, ___

9. 10, 1, 11, 2, 13, 4, 17, 8, 25, 7, ___, ___, ___

10. 99, 72, 77, 49, 54, 20, ___, ___, ___

5.

YOU HAVE A 10-LITER JUG FULL OF WATER. YOU ALSO HAVE AN EMPTY 4-LITER JUG AND AN EMPTY 3-LITER JUG. ALL THE JUGS ARE UNMARKED. USING ONLY THESE JUGS, HOW CAN YOU POUR THE WATER BACK AND FORTH SO THAT YOU END UP WITH 5 LITERS OF WATER IN THE 10-LITER JUG, 1 LITER OF WATER IN THE 3-LITER JUG, AND 4 LITERS OF WATER IN THE 4-LITER JUG?

10. Abby, Bob, and Chuck each entered a dog in the dog show. Their dogs, which took the top three prizes, were a boxer, a collie, and a dachshund. Use the following information to find each person's dog and the prize it took.

(1) This was the first show for Abby's dog.

(2) Bob's dog was not the collie.

(3) In last year's show, the boxer won a higher prize than the collie.

(4) Abby's dog won a higher prize than Chuck's dog.

(5) Bob's dog won a higher prize than Abby's dog.

THE PEOPLE ON A CERTAIN ISLAND ARE DIVIDED INTO TWO GROUPS - THE TRUTH-TELLERS, AND THE LIARS. THE TRUTH-TELLERS ALWAYS TELL THE TRUTH. THE LIARS ALWAYS LIE. THERE ARE NO HALF-TRUTHS OR HALF-LIES. A STRANGER CAME TO THE ISLAND ONE DAY AND SAW THREE OF THE NATIVES STANDING TOGETHER.

A. THE FIRST NATIVE SAID, "I AM NOT A LIAR." THE SECOND NATIVE SAID, "HE'S LYING." THE THIRD NATIVE SAID, "THEY'RE BOTH LYING." WHAT WAS THE THIRD NATIVE - A TRUTH-TELLER OR A LIAR?

B. COULD THE FIRST NATIVE HAVE SAID, "I AM A LIAR"? EXPLAIN YOUR ANSWER.

C. THE STRANGER ASKED ONE OF THE NATIVES WHETHER OR NOT HE WAS A LIAR. THE NATIVE ANSWERED, BUT THE STRANGER DIDN'T HEAR HIM. THE SECOND NATIVE SAID, "HE SAID HE'S A LIAR, AND HE IS." IS THE SECOND NATIVE A LIAR OR IS HE A TRUTH-TELLER? WHAT ABOUT THE FIRST NATIVE?

D. THE STRANGER ASKED ONE OF THE NATIVES WHETHER OR NOT HE WAS A LIAR. THE NATIVE ANSWERED, BUT THE STRANGER DIDN'T HEAR HIM. THE SECOND NATIVE SAID, "HE SAID HE'S A LIAR, BUT HE ISN'T." IS THE SECOND NATIVE A LIAR OR IS HE A TRUTH-TELLER? WHAT ABOUT THE FIRST NATIVE.

E. THE THREE NATIVES ARE STANDING BY A FORK IN THE ROAD. THE STRANGER ASKS WHERE THE TWO BRANCHES OF THE ROAD LEAD. THE FIRST NATIVE SAYS THEY BOTH LEAD TO THE VILLAGE. THE SECOND NATIVE SAYS THEY BOTH LEAD TO THE JUNGLE. THE THIRD NATIVE SAYS THAT ONE LEADS TO THE VILLAGE AND THE OTHER TO THE JUNGLE. SINCE THE ENTIRE ISLAND IS MADE UP OF EITHER JUNGLE OR VILLAGES, THE STRANGER KNOWS THAT ONE OF THE NATIVES MUST BE TELLING THE TRUTH. BUT WHICH ONE?

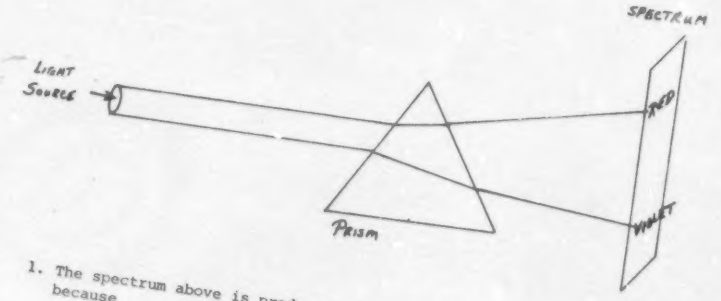
CRITICAL ANALYSIS EXERCISE

A student placed some leaves of a corn plant which had been exposed to light for two hours in a test tube and added a little water. To this tube he then added Fheling's solution, which turns red when in contact with a hot glucose solution. On heating the contents of the test tube to the boiling point he found that the solution became red. He concluded that the leaves had produced glucose by the process of photosynthesis. To reach this conclusion he made assumption below. Use the following key to classify his assumptions.

KEY: A. A justifiable and necessary assumption.
B. A justifiable but unnecessary assumption
C. An unjustified assumption or irrelevant assumption
D. Not an assumption, a restatement of results.

1. _____ Glucose is formed most abundantly in leaves.
2. _____ Some other types of leaves will give the same results as those described.
3. _____ Only green leaves will give the test for glucose.
4. _____ The glucose will turn to alcohol by fermentation.
5. _____ Fehling's solution will not turn red spontaneously.
6. _____ A glucose solution will not turn red spontaneously.
7. _____ Fehling's solution will not turn red when boiled with pure water.
8. _____ The color from the leaves did not affect the test for glucose.
9. _____ The solution turned red after boiling.

CRITICAL ANALYSIS EXERCISE



1. The spectrum above is produced when white light passes through a prism because
   (a) the prosm adds color to the passing light rays.
   (b) different wavelengths of light are separated into distinct bands as the pass through the prism.
   (c) prisms retain some light, allowing only part of the rays to leave.
   (d) white light cannot be transmitted through glass, only colored light.

2. If light of one pure color (yellow) were projected onto a colorless glass prism
   (a) no light would appear on the right side of the prism.
   (b) yellow light would appear on the right side of the prism.
   (c) a dim white light would appear on the right side of the prism.
   (d) the complementary color of yellow would appear on the right side of the prism.

If a chlorophyll solution were placed between the light source and the prism, the spectrum would
(a) have green blacked out since chlorophyll absorbs green light.
(b) show green since chlorophyll does not absorb green.
(c) look the same as if no chlorophyll were used.
consist only of red and violet.

CRITICAL ANALYSIS EXERCISE

Five geranium plants were treated as follows:

Placed in light:

Plant I	Half of each leaf covered with aluminum foil to exclude light
Plant II	Upper and lower sufrace of leaves covered with vaseline
Plant III	Placed in jar containing no carbon dioxide

Placed in dark:

Plant IV	Leaves removed and placed with petioles immersed in glucose solution
Plant V	No treatment

Results:

Plant I	Half exposed to light had starch
Plant II	No starch
Plant III	No starch
Plant IV	Starch, expecially along veins of leaves.
Plant V	No starch

Use the following key to classify the statements below:

KEY: Each interpretation of the data below is

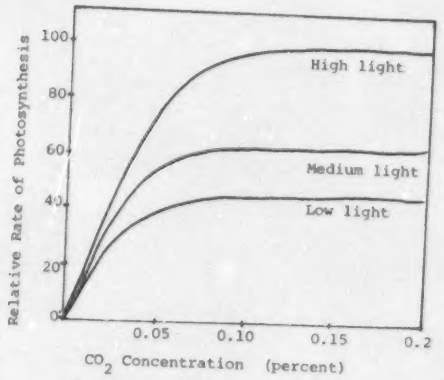
A. rejected on the basis of data presented.

B. supported by data.

C. logical, but the experiment is not designed to test it.

1. _____The presence of starch indicates photosynthesis only if the leaf is deprived of an outside source of glucose.
2. _____As starch may diffuse from its site of origin throughout a leaf, its presence is no indication of where it was formed.
3. _____Light is necessary for starch formation in plants.
4. _____Glucose is necessary for starch formation in plants.
5. _____This experiment lacks a control.
6. _____Plant II had no CO_2 intake as the stomata were covered.
7. _____The roots of a plant may store starch.

CRITICAL ANALYSIS EXERCISE



This diagram shows the relationship between the rate of photosynthesis, light and CO_2.

1. For maximun growth these data indicate that plants should be grown in CO_2 concentration of
   (a) less than 0.5% and high light intensity.
   (b) 0.10% or high and medium light intensity.
   (c) 0.2% and low light intensity.
   (d) 0.10% and high light intensity.
2. Concentration of CO_2 in atmosphere is normally 0.04%. If the data in the graph are correct, then plants in full sunlight are photosynthesizing
   (a) at less than maximum rate.
   (b) faster than they should.
   (c) at maximum rate.
   (d) faster than the plant in low light in the experiment.
3. If you wanted to prevent photosynthesis in a plant in full sunlight, it would be best to put the plant in a container with CO_2 concentration of
   (a) 0.0%
   (b) 0.05%
   (c) 0.10%
   (d) 0.2%

PEARL ⑯ VOCABULARY

HIGHLIGHTED SKILLS

Comprehension
Concept Development

RATIONALE

The teacher provides a variety of exercises designed to help students understand new words and the concepts they represent. Some exercises help students become familiar with the words themselves and other exercises help students learn word meanings.

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      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ6R
      j. Calendar
      k. Student Guide and Checklist
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    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"I think word finds and crosswords are helpful for vocabulary; they're always a big help on the tests."

"The think I enjoyed most was the word find. It was easy to do and prepared us for what we were going to take up."

WORD ANALYSIS

List three words you know that use the underlined word part, then give your own definition for the word part.

photo synthesis

_____ _____ _____

Definition:

chemo synthesis

_____ _____ _____

Definition:

photosynthesis - chemosynthesis

_____ _____ _____

Definition:

aero bic

_____ _____ _____

Definition:

an aero bic

_____ _____ _____

Definition:

glyco lysis

_____ _____ _____

Definition:

glyco lysis

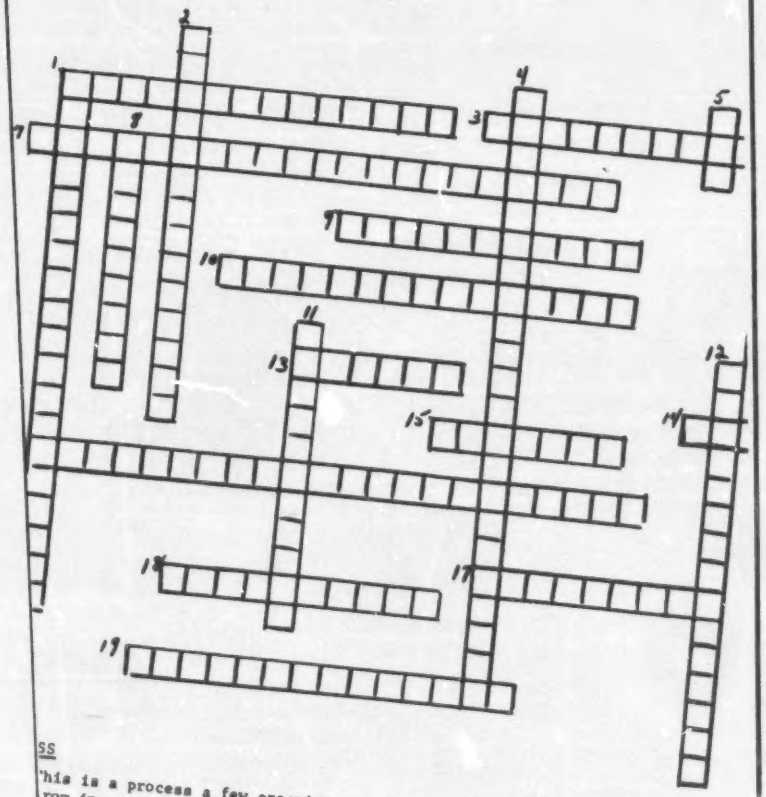
_____ _____ _____

Definition:

CHAPTER SIX: VOCABULARY WORD SEARCH

A	R	O	T	P	E	C	A	P	R	E	S	P	I	R	A	P	O	R	I	E	N	C	H	Y	M	O	S	Y	N
C	E	E	E	R	S	I	S	E	H	T	N	Y	S	O	M	E	H	C	H	E	M	O	S	Y	O	S	I	L	I
T	S	I	S	O	A	T	S	C	R	O	A	L	I	X	E	G	E	L	L	U	L	A	P	A	C	T	I	C	A
A	F	Y	O	P	R	E	N	Y	I	A	T	M	T	I	S	L	I	G	H	T	R	E	A	C	T	I	O	N	S
S	L	A	C	T	I	C	A	C	I	D	R	O	C	K	L	Y	C	P	Y	R	I	N	R	T	O	U	S	H	O
I	I	X	U	R	P	R	Z	L	W	A	A	U	A	U	W	L	Z	Y	A	O	T	Z	T	T	G	I	H	W	P
S	I	S	L	Y	S	P	A	C	L	Y	C	R	L	E	N	G	L	Y	C	O	L	Y	S	I	S	R	D	H	H
H	O	S	G	E	E	N	I	T	R	O	P	A	P	R	E	S	P	R	E	D	N	Z	Y	O	M	X	R	A	Y
P	H	Y	L	L	R	S	Y	S	O	S	R	M	A	M	C	H	A	U	I	N	I	C	M	N	E	H	E	R	D
I	L	N	Y	O	Y	Y	L	L	E	R	G	Y	L	L	O	U	L	V	A	A	Z	C	R	R	E	E	S	E	R
C	I	T	R	I	O	N	O	R	E	M	Y	Z	N	E	S	I	P	T	H	I	R	Y	A	A	H	T	P	H	O
E	G	H	E	P	S	T	I	S	O	A	C	E	I	O	N	C	T	C	I	T	R	C	I	C	C	L	I	S	G
L	H	E	D	R	O	H	P	Y	C	P	O	R	N	A	C	I	D	A	C	C	E	P	T	O	I	C	R	P	E
L	Y	S	I	S	T	I	O	W	I	H	L	I	G	T	V	C	L	C	D	E	P	H	O	P	Y	R	A	I	N
U	N	I	C	E	R	S	C	H	L	O	R	O	P	H	Y	L	L	I	T	I	O	S	Y	N	T	H	T	R	A
L	O	S	T	A	L	P	H	H	O	T	O	X	I	D	A	M	T	D	I	O	X	N	E	S	I	S	I	I	C
P	H	O	T	O	S	Y	N	T	H	E	S	I	S	E	A	P	E	Z	C	H	L	O	R	O	S	Y	O	N	C
I	Y	I	R	D	Y	D	A	R	O	H	G	X	I	D	R	T	L	C	R	E	S	P	I	R	I	W	N	A	E
O	O	D	A	R	K	R	E	A	C	T	I	O	N	S	O	C	I	B	F	A	T	I	O	N	C	P	I	T	P
N	C	R	D	I	O	E	C	D	L	S	S	I	I	T	R	A	T	O	A	A	H	L	O	R	O	P	S	I	T
E	I	O	E	P	L	A	T	E	A	E	S	S	P	E	C	L	I	O	N	Y	I	H	Y	L	L	W	L	E	O
R	E	S	P	I	R	C	O	I	T	R	I	P	S	E	R	Y	D	R	O	G	E	N	C	I	T	R	I	G	R

ALCOHOLIC
CELLULAR RESPIRATION
CHEMOSYNTHESIS
CHLOROPHYLL
CITRIC ACID CYCLE
DARK REACTIONS
ENZYME
GLUCOSE
GLYCOLYSIS
HYDROGEN ACCEPTOR
LACTIC ACID
LIGHT REACTIONS
OXIDATION
PHOTOSYNTHESIS
PYRUVIC ACID
RESPIRATION
RESPIRATORY ENZYME CHAIN



SS

his is a process a few organisms are able to use to make food using energy rom inorganic chemical reaction

ese are the steps of photosynthesis that do not use light energy directly

is is a process which occurs in yeast cells when oxygen is not available. produces energy the yeast cells and produces alcohol & carbon dioxide waste.

e compound is the endproduct of glycolysis.

ing this phase of respiration, the glucose molecule is further broken into carbon dioxide and high energy hydrogens.

e compounds are needed by each and every reaction in the cell. They rol the rate of these reactions (usually speed them up) but they are changed by the reaction.

PEARL (17) GRAPHIC AIDS

HIGHLIGHTED SKILLS

Comprehension
Critical Thinking

RATIONALE

The teacher provides exercises to help students use the various types of graphic aids. Graphic aids help students learn and help them transmit information.

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TEACHER/STUDENT REACTION

"I assumed that all students could work with tables and graphs by the time they got to my course, but, of course, they couldn't. Now I have developed exercises that will help all my students become more proficient in the reading, interpreting, and making of graphs and tables."

READING A TABLE

As a part of their research into human blood types, scientists might be concerned with the blood groups of various peoples on earth. Are the blood groups the same for all populations on earth? Do all peoples have the same percentage of each blood group in their population? The facts might be in a table like the one on the other sheet of this lesson. A table lists facts or other information in neat columns and rows.

PART A. To read a table, first study the title, subtitle, headings, and other labels. They can tell you what kind of information is in the table and how that information is arranged. Refer to the balbe on the other sheet of this lesson to answer the questions below.

1. According to the title and subtitle, this table will tell you about how blood types differ among_____.

the table. The column headings explain what

heading does not name a

TITLE

DISTRIBUTION OF THE FOUR BLOOD GROUPS AMONG A FEW PEOPLES OF THE WORLD

SUBTITLE

THIS TABLE COMPARES THE BLOOD TYPES OF PEOPLE FROM SEVERAL DIFFERENT PARTS OF THE WORLD.

COLUMN HEADINGS

COLL

PEOPLE	O	A	B	AB
U.S.A.-White	45.0%	41.0%	10.0%	4.0%
U.S.A.-Negro	49.3%	26.0%	21.0%	3.7%
Swedish	37.3%	40.7%	10.3%	5.1%
Japanese	31.2%	38.4%	21.8%	8.6%
Hawaiian	36.5%	60.8%	2.2%	0.5%
Chinese	30.0%	25.0%	35.0%	10.0%
Australian aborigine	53.1%	44.7%	2.1%	00.0%
North American Indian	91.3%	7.7%	1.0%	0.0%

ROWS

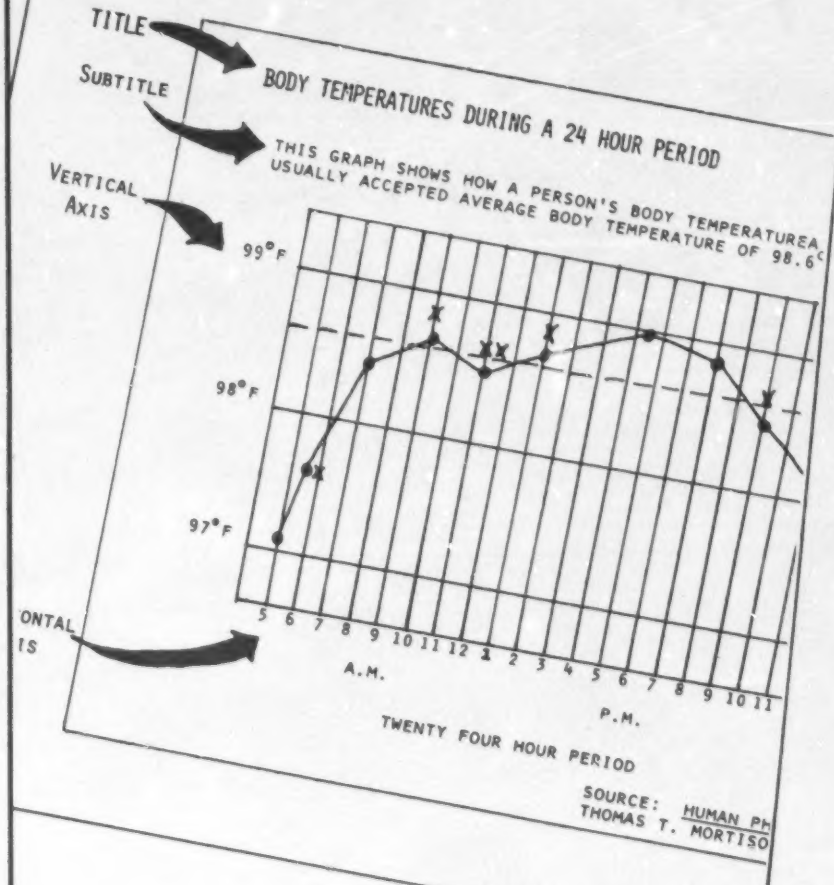
% = PERCENTAGE

SOURCE: HUMAN PHYSIOLOGY, THOMAS F. MORRISON ET AL. 1972

EXPLANATION OF SYMBOLS

SUPPLIER OF INFORMATION

READING A LINE GRAPH



READING A LINE GRAPH

Suppose you want to show ina dramatic way how something has changed. It could be a gradual change or a sudden change, but you want to make your point simply. One of the best ways to do this is to make a line graph. A line graph uses a simple line, called an indicator line, to show how approximate numbers change over a period of time. If the line goes up, it shows things have increased in some way. If it goes down, things have decreased. This is called a trend. If the line goes up and down once or several times it show fluctuations.

The simple line graph on the other sheet of this lesson shows what happens to body temperature over a 24 hour period.

PART A. *The line graph has a title and subtitle that tells what it is about, a vertical axis that runs up and down, and a horizontal axis that runs from side to side. This simple line graph, however, needs no key to explain its line. Look at the graph and answer the following questions.*

1. By glancing at the indicator line, would you say that body temperature is constant? _____
2. What does the horizontal axis show? Circle the answer.
   (a) temperature (b) time (c) trends
3. What does the vertical axis show? Circle the answer.
   (a) time (b) temperature (c) fluctuations

PART B. *By carefully comparing the information on the two axes, you should be able to tell something about a person's body temperature during a day.*

5. At what time of the day is a person's body temperature usually the highest? (a) _____ the lowest? (b) _____
6. A person's body temperature during a day can best be called (circle one)
   (a) steady (b) uneven (c) declining
7. From the graph, is a person's body temperature rising in the evening?
   (a) can't tell (b) yes (c) no
8. By reading the graph can you tell what a person's body temperature would be at 3:00 in the afternoon.
   (a) yes (b) no
9. What does the dotted line in the graph represent?

PEARL (18) SQ6R

HIGHLIGHTED SKILLS

Comprehension
Vocabulary
Evaluate Material
Critical Thinking
Organize & Summarize

RATIONALE

SQ6R (Survey, Question, Read, Reflect, Reread, Record, Recite, and Review) is a method students can learn to help them extract meaning from a reading independently. This process can be taught step by step with plenty of review and reinforcement.

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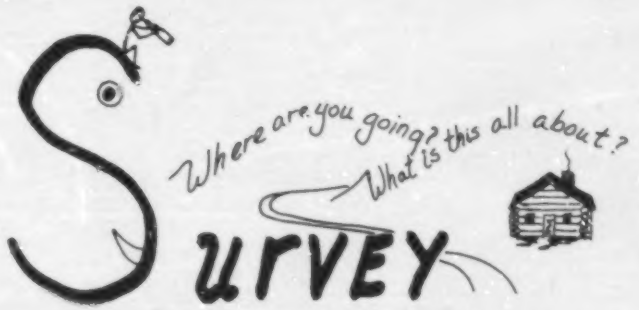
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

TEACHER/STUDENT REACTION

"SQ6R helps you remember what you read."

"I like the SQ6R because it helps me study and prepare better for a test."



Get an idea of where youre going.

Find our what you will be reading about before you begin.

Get an eagle-eye view of the whole chapter.

This step will prepare your mind for what you are going to be studying. If the chapter is written well you will learn alot even before you begin the actual reading assignment.

Read the title. — Think about what it means.

Read the introduction. — What's this chapter all about?

Read the headings. — How is the author going to attack this topic?

How is the chapter organized?

Study the pictures.

Read the captions. — What can you learn from these?

Skim the paragraphs for boldface print.

Read The summary.

Now the chapter is familiar territory. You can begin your study with confidence.

Now that the survey is done, the next step is to figure out what you are supposed to learn from your reading. Establish purposes for reading. You want to know what's important, what you should study.

Ask yourself questions. Go through the chapter section by section. Turn headings into questions. For example, if the heading reads, "Biology, Matter, and Energy", you ask, "What do matter and energy have to do with biology?"

Sometimes your book begins each chapter with a list of objectives. Turn these into questions.

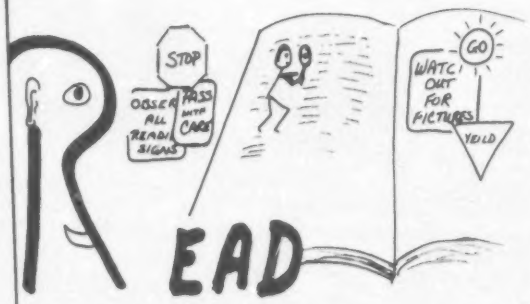
Check out the questions at the end of the chapter. These will help you decide what's important.

Perhaps your teacher told you what to look for. Use this to make questions.

Now you can set about doing your assignment with a definite purpose in mind. You're going to find the answers to your questions.

Your questjions are like a shpping list. Just as a shopping list helps you pick only the things you need from the thousands of products on the shelp, questions will help you get the important ideas out of the thousands of wsords in the chaptdr.

Sometimes your mind will wander off while your eyes read the words. These questions keep your mind on the job.



Now read. Read as though you were out sightseeing and don't want to a thing. Look for the answers to your questions. Do stop and go ng. Stop frequently and ask yourself, "What have I just read?" about what you are reading. Go back and reread parts you find to understand. Write down important ideas when you find them. Don't up the pictures. They are not there just to take up space. The r put them there for a reason. Study them along with the reading. The author has used special reading signs to help you. Pay attention l headings, italics, and bold print. The author is saying, "Hey, is important!"

Watch your speed. Some passages read fast and easy while others will ch slower going. Sometimes there is just one important idea on a page, but other times each sentence is important.

Watch for topic sentences. Look for the main idea. Find the supporting l.

PEARL (19) CALENDAR

HIGHLIGHTED SKILLS

Use of time
Organize & Summarize

RATIONALE

The calendar provides a tentative timeline for accomplishing the work of the chapter. The approach suggested by Project Capable is quite complex. The calendar includes all aspects of the learning strategy, when they are assigned, and when they are due. The calendar will simplify the coordination of the classroom activities for both the students and the teacher.

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TEACHER/STUDENT REACTION

"I liked the calendar because then I had a schedule of what had to be done at a certain time and I was organized."

"I liked the calendar because it helped me to schedule my time a lot better. I wish every teacher would give us one every week."

CALENDAR

	1 Monday	2 Tuesday	3 Wednesday	4 Thursday	5 Friday
Work Due	Double Period	pp 62-65 P.C. 1-11	Word find due pp 66-68 P.C. 12-14	Prelab	PAPERLAB - CAE due pp 68-72 P.C. 15-18 Study Guide
	Survey Question Overview DRL:	Discuss Photosynthesis Respiration & Cell energy	Discuss Light RX Overview → Details → Summary	Lab: light & chlorophyll	Discuss Dark RX Overview → Details → Summary
	Last 15 min.: Set up Lab for Thursday	DRL: Light RX of Photosynthesis Overview	DRL: Dark Reactions of Photosynthesis Overview		
Assignment	PaperLab - CAE WORD FIND Read pp 62-65 P.C. 1-11 - Study Guide	Read pp 66-68 P.C. 12-14 - Study Guide	Read pp 68-72 P.C. 15-18 - Study Guide Prelab Crossword Puzzles		

STUDENT GUIDE & CHECKLIST

ASSIGNMENT	DATE ASSIGNED	DATE DUE	DONE
Paper Lab - CAE WORD FIND Read pp 62-65 P.C. 1-11 - Study Guide Read pp 66-68 P.C. 12-14-Study Guide Read pp 68-72 P.C. 15-18-Study Guide Prelab Crossword Puzzles Photosynthesis Quiz Paper Lab - CAE Assign Prelab Study for test Vocabulary Exercises Read pp 72-75 P.C. 19-23-Study Guide Paper Lab - CAE Read p. 75 P.C. 24-25 - Study Guide Read pp 75-77 P.C. 26-28-Study Guide Study for test			

HIGHLIGHTED SKILLS

Use of time
Organize & Summarize

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      c. Concept Development
      d. Study guide
      e. Content Aids
      f. Critical Thinking
      g. Vocabulary
      h. Graphic Aids
      i. SQ6R
      j. Calendar
      k. Student Guide and Checklist
  B. Student Preparation
    1. Orientation/Introduction
    2. Motivation & Attention
    3. Vocabulary/Clarification of Concepts
    4. Background
    5. Purpose Set
    6. Skill Review/Direction Review
  C. Activity
  D. Discussion & Comprehension Check

RATIONALE

The student guide and checklist goes hand in hand with the calendar in coordinating the learning activities for the students.

TEACHER/STUDENT REACTION

"I found that the checklist helped me very much. I knew exactly when everything was due because it was in writing and not by word of mouth. I could go ahead if by chance my schedule did not permit any time the next day."

"I always knew what was for homework. I didn't have to worry about missing the assignment."